

Savannah River Site Annual Meteorology Report for 2007 (U)

Washington Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U. S. Department of Energy under contract no. DE-AC09-96SR18500

Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement recommendation or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Savannah River Site Annual Meteorology Report for 2007 (U)

E. D. Kabela

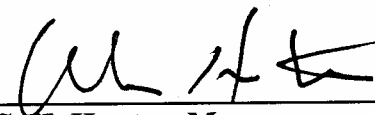
Approvals:

 3/3/08

E. D. Kabela, Author
SRNL Atmospheric Technologies Group

 3/3/08

D. W. Werth, Technical Reviewer
SRNL Atmospheric Technologies Group

 3/3/08

C. H. Hunter, Manager
SRNL Atmospheric Technologies Group

Washington Savannah River Company
Savannah River Site
Aiken, SC 29808

Contents

Overview	1
Background	2
The General SRS Climate	2
Overview of Meteorological Monitoring at the Savannah River Site	2
Data Sources for the 2007 Report	3
The SRS Climatology for 2007	5
Highlights	5
Temperature	5
Precipitation	6
Atmospheric Moisture	6
Heat Stress	6
Wind	7
Barometric Pressure	7
Solar Radiation	8
References	8
Tables	9
Figures	15
Appendix A	31

List of Tables

Table 1. Means and Extremes for 2007

- (a) Temperature and Precipitation**
- (b) Dew Point, Wet Bulb, Relative Humidity, and Wet Bulb Globe Temperature**
- (c) Wind Speed, Barometric Pressure, Solar Radiation, and Heating / Cooling Degree Days**

Table 2. Monthly and Annual Average and Extreme Temperatures, 1977-2007

Table 3. Monthly and Annual Average and Extreme Rainfall, 1977-2007

Table 4. Monthly and Annual Rainfall, Manual Gauges

Table A Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Wind Speed Category, 2007

- A.1 A Area Tower**
- A.2 C Area Tower**
- A.3 D Area Tower**
- A.4 F Area Tower**
- A.5 H Area Tower**
- A.6 K Area Tower**
- A.7 L Area Tower**
- A.8 P Area Tower**
- A.9 2m Level Central Climatology Tower**
- A.10 18m Level Central Climatology Tower**
- A.11 36m Level Central Climatology Tower**
- A.12 61m Level Central Climatology Tower**
- A.13 61m Level Central Climatology Tower, Winter**
- A.14 61m Level Central Climatology Tower, Spring**
- A.15 61m Level Central Climatology Tower, Summer**
- A.16 61m Level Central Climatology Tower, Fall**

List of Figures

Figure 1. Meteorological Monitoring Stations

Figure 2. Summary of Daily Data for 2007

Figure 3. Daily High and Low Temperatures for 2007

Figure 4. SRS Annual Average Temperature 1977-2007

Figure 5. SRS Monthly Average Temperature

Figure 6. Number of Freezing ($<32^{\circ}\text{F}$) and Sweltering ($>90^{\circ}\text{F}$) Days

Figure 7. Daily Precipitation for 2007

Figure 8. SRS Annual Precipitation 1977-2007

Figure 9. SRS Monthly Precipitation

Figure 10. Daily High and Low Humidity for 2007

Figure 11. SRS Annual Average Humidity 1977-2007

Figure 12. SRS Monthly Average Minimum Humidity

Figure 13. Daily Average Wind Speed for 2007

Figure 14. Annual Wind Rose Plots for 2007, 61m Level

(a) A, C, D, and F Area Towers

(b) H, K, L, and P Area Towers

Figure 15. Annual Wind Rose Plots for 2007, Central Climatology Tower, All Levels

Figure 16. Seasonal Wind Rose Plots for 2007, Central Climatology Tower, 61m Level

Figure 17. Daily Average Barometric Pressure for 2007

Figure 18. Daily Total Solar Radiation for 2007

Overview

Summaries of meteorological observations collected at the Savannah River Site in 2007 depict a year that overall saw near normal temperatures and below normal precipitation. Annual rainfall for 2007 was 11.77 inches less than the most recent 30-year average (1977-2006), which ranks as the second driest year since 1952. May's total rainfall of 1.23 inches was the lowest and November's total rainfall of 0.55 inches was the third lowest in the 55 years of record; conversely, the monthly rainfall in December, 8.79 inches, was the third highest on record. The largest daily rainfall of 2.50 inches was due to a strong low pressure system that moved from the Gulf of Mexico, over SRS, and up the Atlantic Coast on April 15th. Rainfall of 0.01 inches or more occurred on 84 days during the year.

The annual average temperature for 2007, 64.3°F, was the 19th *warmest* of any year in a record that dates to 1968. Conditions were warmer than average in 5 of the 12 months of the year. Above average temperatures were particularly prevalent during the summer and fall. October's average temperature of 68.7°F was the fifth warmest on record; August's average temperature of 81.9°F was the eighth warmest on record; conversely, July's average temperature of 77.4°F was the second coldest on record. The coldest temperature of the year was 19.7°F on the morning of February 17; the warmest temperature was 105.4°F on the afternoon of August 10.

Several significant wind events occurred during the winter and early spring of the year. The highest measured ground-level wind speed (gust), 44.4 miles per hour (mph), was associated with a strong low

pressure system moving over SRS during the day on April 15th. A tight pressure gradient from the same strong low pressure area over produced the highest daily average wind speed of 20.5 mph.

The most notable weather 'events' of 2007 were the formation of a La Niña during the early fall, lasting through the end of the year, the near-normal hurricane season, the latest ever killing freeze to strike the region, and the persistent drought conditions.

After beginning the year under a weak El Niño, June was accompanied by weak La Niña conditions, which increased to a moderate La Niña by the end of October. The effects of La Niña were felt during the 2007 tropical season. After a relatively calm 2006 season, 2007 saw six hurricanes and eight tropical storms, with three tropical storms (Barry, Erin, and Gabrielle) and one hurricane (Humberto) making landfall in the U.S. (NOAA 2007e). Only Tropical Storm Barry directly affected SRS during the 2007 hurricane season

Background

The General SRS Climate

The Savannah River Site region has a humid subtropical climate characterized by relatively short, mild winters and long, warm, and humid summers (Oliver and Fairbridge, 1987).

Summer-like conditions typically last from May through September, when the area is frequently under the influence of a western extension in the semi-permanent Atlantic subtropical anticyclone (i.e. the 'Bermuda' high). Winds in summer are light and cold fronts generally remain well north of the area. Daily high temperatures during the summer months exceed 90°F on more than half of all days on the average. Scattered afternoon and evening thunderstorms are common.

The influence of the Bermuda high begins to diminish during the fall as continental air masses become more prevalent, resulting in lower humidity and more moderate temperatures. Average rainfall during the fall is usually the least of the four seasons.

In the winter months, mid-latitude low pressure systems and associated fronts often migrate through the region. As a result, conditions frequently alternate between warm, moist, subtropical air from the Gulf of Mexico region and cool, dry polar air. The Appalachian Mountains to the north and northwest of the SRS help to moderate the extremely cold temperatures that are associated with occasional outbreaks of Arctic air. Consequently, less than one-third of winter days have minimum temperatures below freezing on average, and days with temperatures below 20°F are infrequent. Measurable snowfall occurs an average of once every 2 years.

Tornadoes occur more frequently in spring than the other seasons of the year. Although spring weather is somewhat windy, temperatures are usually mild and humidity is relatively low.

Overview of the Savannah River Site Meteorological Monitoring Program

Meteorological data are collected at SRS from a network of nine primary monitoring stations (Fig. 1). Towers located adjacent to each of eight operations areas (A, C, D, F, H, K, L, and P areas) are equipped to measure wind direction, wind speed, temperature, and dew point at a height of 61 meters (m) above ground. Temperature and dew point are also measured at 2m. A ninth tower near N-Area, known as the Central Climatology site (CLM), is instrumented with wind, temperature, and dew point sensors at four levels: 2m (4m for wind), 18m, 36m, and 61m. The CLM site is also equipped with an automated tipping bucket rain gauge, a barometric pressure sensor, and a solar radiometer near the tower at ground level. Data acquisition units at each station record a measurement from each instrument at 1-second intervals. Every 15 minutes, 900 data points are processed to generate statistical summaries for each variable, including averages and instantaneous maxima, and the results are uploaded to a relational database for permanent archival. All aspects of the meteorological data collection program meet or exceed applicable regulatory criteria. Parker and Addis (1993) provide a complete description of the meteorological monitoring program at SRS.

Quality assurance of the data is conducted in two phases: an initial screening of recent data, followed by an in-depth review and final quality classification. The initial

screening, performed twice daily by qualified instrument technicians, consists of a thorough examination of 15-minute data retrieved from the database, in conjunction with a summary of instrument diagnostics obtained from the local data acquisition units. Potential problems are noted in a daily checksheet and, as needed, data acquisition unit software is configured to assign a quality control tag to data collected from the questionable instruments. Quality flags are also set during periods of calibration and maintenance.

The second phase of the quality assurance process is conducted according to formal procedure (SRNL, 2004). Daily checksheets generated during the initial screening, tower-specific logbook entries, initial quality flags, and time series plots of related data are reviewed to determine a final quality status for each record. All records permanently archived in the data base are identified as good, fatal, intermittent, biased, or uncalibrated.

Tall Tower Monitoring System

ATG's Tall Tower facility near Beech Island, SC provides a set of high-quality meteorological measurements that is unique to the southeast U.S. This facility utilizes fast-response sonic anemometers, water vapor sensors, and barometric pressure sensors, and slow-response temperature sensors and relative humidity sensors. Data are collected at 30m, 61m, and 304m above ground level. Spread-spectrum modems at each measurement level transmit raw data to a redundant set of PCs at the Savannah River National Laboratory (SRNL). Data processing software on the PCs determine mean values and other statistical quantities every 15 minutes and uploads the results to the relational database.

Additional Measurements

Additional precipitation measurements are collected from a network of 12 plastic wedge rain gauges across the SRS (See Fig. 1). These gauges are read manually by security or operations personnel once per day, usually around 6 am. The daily data are reported to the SRNL Atmospheric Technologies Center, reviewed to correct obvious flaws, and manually entered into a permanent electronic data base.

Additional measurements of temperature and relative humidity are recorded from a weather station located in A-Area, adjacent to SRNL. This station consists of a standard National Weather Service 'cotton region' instrument shelter. Data collected from this station are manually tabulated for archival as daily high and low values of temperature and relative humidity. Tabulated values are then entered into a permanent electronic data base.

Data Sources for the 2007 Report

Summaries provided with this report are based on the following sources of data:

- Ground level (surface) measurements of *temperature (2m)*, *dew point temperature (2m)*, *wind speed (4m)*, *precipitation*, *barometric pressure*, and *solar radiation* from CLM, as well as meteorological quantities derived from these primary data, such as *relative humidity* (temperature and dew point), *wet bulb temperature* (temperature and dew point), *wet bulb globe temperature* (temperature, dew point, wind speed, and solar radiation), and *cooling/heating degree days* (temperature).

- Wind speed and direction from measurements collected at each of the four levels of the CLM tower and the 61m level of the eight area towers.
- Precipitation from the network of manually-read rain gauges

A series of SAS System® software routines were used to extract the desired data sets from the data base and perform initial statistical processing on all records with a QA status of 'good'. More than 99% of the data used in this report met this QA classification in 2007.

Output from the initial processing was then imported into an Excel® spreadsheet to generate the final summaries that are presented in the report.

Long-term climatological records are available for temperature, precipitation, and relative humidity. Statistics generated from these data are used for comparisons with the 2007 summaries.

Available records of SRS temperature and relative humidity begin in 1968. From 1968 through 1995, the climatological statistics used in this report are based on the daily maxima and minima recorded at the SRNL instrument shelter. After 1995, these statistics are based on measurements from the 2m level of CLM.

Precipitation data are available from 1952. For the period 1952 through 1995, statistics presented in the report are based on daily observations from the SRNL rain gauge. Summaries after 1995 are based on data collected from the CLM rain gauge.

Climatology of the SRS for 2007

Highlights

Meteorological data summaries for 2007 depict a year that saw near normal temperatures and below normal precipitation. The annual average temperature of 64.3°F was the 19th warmest of any year in the available record. Relatively warm weather was particularly prevalent during the summer and fall months, with relatively cool weather in the spring and early summer months. Annual rainfall for 2007 was 11.77 inches less than the most recent 30-year average (1977-2006), which made it the second driest year on record. Rainfall was well above average in December; conversely, May and November 2007 were the driest and third driest of any May and November on record. A summary plot of daily observations of temperature, precipitation, relative humidity, and wind speed is given in Figure 2.

Seasonal climatological discussions published by the National Weather Service, Climate Prediction Center (CPC), and the National Centers for Environmental Prediction (NCEP) (NOAA 2007a, 2007b, 2007c, 2007d, and 2007e), suggest that the relatively cool weather observed through much of the eastern U.S. for April through July was due to the persistent presence of a low pressure trough over the New England and Upper Great Lakes region and a relatively weak presence of a subtropical (Bermuda) high over the Southeastern U.S. Only the month of May saw a brief return of high pressure over the Ohio River Valley which contributed to the driest May in the 55 year history of precipitation data for SRS.

August through mid-November saw the return of high pressure over the eastern

two-thirds of the U.S. This contributed to near- or above-normal temperatures and greatly below normal precipitation during this period. August, September, and November ranked among the top ten driest, respectively, for each month. By the end of November, the persistent high pressure over the Ohio River Valley pushed east off the Atlantic coast, bringing a southwesterly return flow pattern to the southeastern U.S. This contributed to the much above normal precipitation observed in December.

Temperature

Monthly average, annual average and daily extreme temperatures for 2007 are summarized in Table 1(a). Similar statistics for a 30-year climatological reference period (1977-2006) are given in Table 2. A plot of observed daily high and low temperatures for 2007 is shown in Fig. 3. Plots of annual average temperature, monthly average daily high and low temperature, and days exceeding significant temperature thresholds (<32°F, >90°F) for 2007 and the 30-year reference period are shown in Figures 4, 5, and 6, respectively.

The annual average temperature for 2007, 64.3°F, was 0.1 degrees below the 30-year climatological average. Monthly average temperatures were below climatological averages for all months of the year except January, March, August, October, and December. Furthermore, average temperatures for February, April, May, June, and July ranked among the ten coldest on record for those months. Temperatures above 90°F were observed on 62 days during the year and around 87% of total days in August. Temperature extremes ranged from 19.7°F on February 17 to 105.4°F on August 10. Daily low temperature records were set on March 18,

April 8 and 9, July 4, 5, 13, 23, 24, and 25, and November 7 and 8. A daily high temperature record was set on January 15.

Monthly and annual total heating and cooling degree days (based on a reference temperature of 65°F) are summarized in Table 1(c).

The last spring killing freeze (temperature <28°F) date was April 8 which was the latest killing freeze ever recorded. The first fall killing freeze was November 16. April 9 was the last frost date (temperature <32°F) of the spring, and November 8 was the first frost date of the fall.

Precipitation

Annual, monthly, and daily rainfall statistics for 2007 are summarized in Table 1(a). Monthly and annual totals for the previous 30-years (1977-2006) are given in Table 3. Monthly and annual rainfall totals for the 12 manually read gauges across the SRS are summarized in Table 4. A plot of daily totals (midnight to midnight) for the CLM site for 2007 is shown as Figure 7. A comparison of annual and monthly rainfall for 2007 and the 30-year climatological reference period are shown in Figures 8 and 9, respectively.

Total precipitation at the CLM site, 36.75 inches, was 11.77 inches less than the 30-year average, making it the second driest year on record. The monthly total of 1.23 inches for May was the lowest on record for the month and November's total rainfall of 0.55 inches was the third lowest on record. Conversely, December's total of 8.79 inches was the third highest on record. The heavy rain that occurred on April 15 (2.50 in) was due to a strong low pressure system moving slowly over the Southeast.

Measurable precipitation (>0.01 inch) occurred on 84 days and rainfall greater than 0.5 inch occurred on 25 days.

Atmospheric Moisture

Monthly average, annual average, and daily extreme dew point temperature, wet bulb temperature, and relative humidity for 2007 are summarized in Table 1(b). This table also presents monthly and annual averages of the daily maximum and minimum humidity. A plot of daily observed values of maximum and minimum humidity for 2007 is shown in Figure 10. Plots of annual and monthly averages of humidity for 2007 and the 30-year climatological reference period (1977-2006) are shown in Figures 11 and 12, respectively.

Average relative humidity for 2007 was 67 percent with an average daily minimum of 41% and an average daily maximum of 88%. Days with relative humidity of 20% or less occurred in February, March, April, November, and December. The lowest relative humidity recorded during the year was 15% on February 23. Average daily minimum relative humidity was less than long-term values for each month during the year except October and December.

Observed dew point temperatures ranged from a maximum of 80.8°F on July 9 to a minimum of 8.9°F on January 29. Wet bulb temperature ranged from a maximum of 83.1°F on August 11 to a minimum of 19.3°F on February 17.

Heat Stress

Restrictions on outdoor work due to excessive heat are based on values of the wet bulb globe temperature (WBGT) (WSRC, 1995). Hunter and Minyard (2000) provide a description of WBGT and the

method used at SRS to calculate WBGT from standard meteorological measurements at CLM.

Monthly and annual maximum WBGT and statistics on heat stress category days for 2007 is summarized in Table 1(b). The highest WBGT for 2007 was 94.0°F on August 9. Heat stress Category 5 (WBGT >90.0°F) occurred on 22 days during the summer period. A total of 162 days reached at least Category 1 (WBGT > 77.0 °F) from March through October.

Wind

Monthly average and extreme wind speed at the CLM 4 meter level for 2007 is summarized in Table 1(c). Daily averaged wind speed for the year is plotted in Figure 13. Figures 14(a) and 14(b) show wind rose plots depicting joint occurrence frequencies of wind speed category by wind direction sector at the 61 meter level of the eight area towers. Figure 15 provides wind rose plots for the 4 levels of measurement at CLM. Seasonal wind rose plots for 2007 for data from the 61m level of CLM are shown in Figure 16. Tables of the joint frequency data used to create the wind rose plots are given in Appendix A.

Monthly average wind speeds were highest in January and February, with monthly averages exceeding 4.5 mph. The highest instantaneous wind speed recorded at the 4m level, 44.4 mph, was associated with a low pressure system moving over SRS during the day on April 15th. A tight pressure gradient from the same strong low pressure area over the Southeast U.S. produced the highest daily average wind speed of 20.5 mph on April 15. Average wind speeds were generally the lowest during August.

Wind rose plots for the area towers show typical annual patterns for the 61 meter level. This pattern consists of higher frequencies of wind from the northeasterly sectors and the southwesterly to west sectors. Due to the location of the D area tower in the shallow valley formed by the Savannah River, winds are somewhat more frequently from the southeasterly and northwesterly sectors than for the other area towers. Wind roses for CLM also show typical variations in the frequency patterns by level, with progressively higher frequencies of southeasterly winds and lower frequencies of northeasterly and southwesterly winds nearer the ground. Weber (2003) provides a complete description of the wind climatology at the CLM site.

The seasonal wind roses show that higher frequencies of westerly wind occur in the winter and spring and a much higher frequency of northeasterly wind during the late summer and fall.

Barometric Pressure

Annual and monthly average and extreme barometric pressure is summarized in Table 1(c). Daily average barometric pressure is plotted in Figure 17. The occurrence of lowest daily average and 15-minute minimum barometric pressure, 993.9 and 989.1 mb, respectively, were associated with the passage of a strong low pressure system through the area on April 15. The highest daily average and 15-minute maximum barometric pressure, 1022.1 and 1025.2 mb, respectively, were associated with a strong high pressure system that built over the mid-Atlantic region of the U. S. on January 11.

Solar Radiation

Annual and monthly averages and extremes of daily total solar radiation are summarized in Table 1(c). This table also provides monthly and annual values of the fraction of observed solar radiation relative to theoretical clear sky maxima. The monthly theoretical values were estimated from tables published by Budyko (1974). Daily total solar radiation for 2007 is plotted in Figure 18. The average daily values ranged from 214 langleys per day

(ly/day) in December to 551 ly/day in May. The months of February, March, April, May, September, and November were relatively sunny with observed solar radiation greater than 70% of clear sky maximum. January and July were relatively cloudy with monthly average observed solar radiation only 61% and 62% of the clear sky maximum, respectively. Individual daily extremes ranged from 32 ly on December 30 to 713 ly on May 19.

References

Budyko, M. I., *Climate and Life*, Academic Press, New York, NY (1974).

Hunter, C. H., and C. O. Minyard, *Estimating Wet Bulb Globe Temperature Using Standard Meteorological Measurements*, American Meteorological Society 2nd Symposium on Environmental Applications, January 9-14, 2000, Long Beach, CA (2000).

National Oceanic and Atmospheric Administration (NOAA), NOAA News Online, published electronically at www.noaanews.noaa.gov/stories2006/ (2007a)

NOAA, *Seasonal Climate Summary (January – December 2007)*, published electronically at www.cpc.ncep.noaa.gov, Climate Prediction Center, Camp Springs, MD (2007b).

NOAA, *Daily Weather Maps*, National Weather Service, Camp Springs, MD. (2007c)

NOAA, *Climate of 2007 (Annual Report)*, published electronically at www.ncdc.noaa.gov, National Centers for Environmental Prediction, Asheville, NC. (2007d)

NOAA, *Climate of 2007 (Atlantic Hurricane Season)*, published electronically at www.ncdc.noaa.gov, National Centers for Environmental Prediction, Asheville, NC. (2007e)

Oliver, J. E. and R. W. Fairbridge, ed., *The Encyclopedia of Climatology*, Von Nostrand Reinhold, New York, NY (1987).

Parker, M. J. and R. P. Addis, *Meteorological Monitoring Program at the Savannah River Site*, WSRC-TR-93-0106, Westinghouse Savannah River Company (1993).

SRNL Nonproliferation Technologies Section, *Quality Assurance of Meteorological Data*, WSRC Procedure Manual 15.3, Meteorological Monitoring Procedures, NTSP T-113 (2004).

Weber, A. H., R. J. Kurzeja and R. L. Buckley, *Wind Climate Analysis for SRTC's Central Climatology Site*, WSRC-TR-2003-00141, Westinghouse Savannah River Company, Aiken, SC (2003).

Westinghouse Savannah River Company (WSRC), *The SRS Heat Stress Management Program*, Procedure Manual 4Q, Procedure 502, Revision 2 (1995)

Table 1(a) - Means and Extremes of SRS Meteorological Data for 2007

Month	Temperatures (°F)													Precipitation (in)							
	Average					Extremes				Number of Days				Total	Departure from 30yr avg	Rank (1952-2007)	Greatest in 24 Hrs	Date of 24hr max	No. of Days		
	Avg. Daily High	Avg. Daily Low	Month Avg.	Departure from 30yr avg	Rank (1968-2007)	Highest	High Date	Lowest	Low Date	Maximum Above 90 °F	Maximum Above 100 °F	Minimum Below 32 °F	Minimum Below 20 °F						Greater Than 0.01 in.	Greater Than 0.1 in.	Greater Than 0.5 in.
Jan	58.8	40.1	48.6	+2.9	11	74.9	15th	23.5	26th	0	0	8	0	3.27	-1.01	20	0.92	22nd	10	7	2
Feb	58.6	35.5	46.4	-3.2	8	73.6	22nd	19.7	17th	0	0	12	1	3.60	-0.72	23	1.12	21st	7	5	3
Mar	72.2	46.0	58.4	+2.0	14	87.8	25th	26.0	5th	0	0	2	0	1.98	-2.75	6	0.81	2nd	4	3	1
Apr	75.8	48.2	61.8	-2.4	8	87.3	30th	25.7	8th	0	0	2	0	2.95	-0.21	26	2.50	15th	5	2	1
May	82.7	57.8	70.2	-1.7	9	89.8	3rd	43.7	7th	0	0	0	0	1.23	-2.00	1	0.56	13th	4	4	1
Jun	88.1	66.9	76.5	-1.9	10	95.3	24th	61.0	14th	13	0	0	0	4.83	-0.14	22	2.13	3rd	13	9	4
Jul	88.3	68.8	77.4	-4.1	2	94.6	20th	58.9	23rd	11	0	0	0	4.57	-0.94	26	1.59	1st	11	9	3
Aug	94.6	72.4	81.9	+1.7	8	105.4	10th	68.5	29th	27	5	0	0	2.66	-2.22	10	0.91	23rd	10	4	3
Sep	86.7	66.1	75.2	-0.1	18	94.2	11th	52.7	30th	9	0	0	0	0.97	-3.00	6	0.59	13th	3	2	1
Oct	80.1	59.8	68.7	+3.5	5	90.2	9th	43.3	12th	2	0	0	0	1.35	-1.79	20	1.00	24th	6	2	1
Nov	67.6	42.3	54.0	-2.8	13	80.4	14th	26.6	17th	0	0	4	0	0.55	-2.39	3	0.42	22nd	2	2	0
Dec	64.3	43.4	52.3	+4.0	11	78.8	12th	22.3	18th	0	0	5	0	8.79	+5.40	3	2.45	30th	9	7	5
Year	76.6	54.1	64.3	-0.1	19	105.4	10-Aug	19.7	17-Feb	62	5	33	1	36.75	-11.77	2	2.50	15-Apr	84	56	25



Rank by coolest



Rank by warmest



Rank by wettest



Rank by driest

Table 1(b) - Means and Extremes of SRS Meteorological Data for 2007

Month	Dew Point Temperature (°F)					Wet Bulb Temperature (°F)					Relative Humidity (%)					Wet Bulb Globe Temperature (°F)						
	Average	Highest	High Date	Lowest	Low Date	Average	Highest	High Date	Lowest	Low Date	Avg. Daily Maximum	Avg. Daily Minimum	Monthly Avg.	Lowest	Low Date	Highest	High Date	Number of Days				
																		Cat 1 and Above	Cat 2 and Above	Cat 3 and Above	Cat 4 and Above	Cat 5
Jan	37.6	64.8	6th	8.9	29th	43.8	65.8	5th	21.2	29th	88	45	69	24	27th	71.4	5th	0	0	0	0	0
Feb	32.3	61.6	25th	10.2	6th	40.5	62.7	25th	19.3	17th	88	35	63	15	23rd	68.4	13th	0	0	0	0	0
Mar	44.5	65.4	2nd	18.4	17th	51.4	66.6	28th	25.1	5th	88	36	64	19	3rd	79.3	24th	4	0	0	0	0
Apr	43.7	68.2	15th	10.3	7th	52.6	69.5	3rd	23.7	8th	83	30	56	16	8th	80.0	3rd	7	0	0	0	0
May	53.8	67.4	13th	30.2	7th	60.8	70.8	12th	39.7	7th	87	34	60	21	20th	83.4	12th	21	3	0	0	0
Jun	65.4	73.6	25th	51.4	1st	69.2	77.7	30th	59.5	1st	92	45	71	33	24th	90.4	30th	29	24	18	10	1
Jul	66.6	80.8	9th	50.0	23rd	70.4	82.2	9th	56.0	23rd	91	47	72	27	23rd	92.0	9th	30	26	19	9	2
Aug	70.2	79.1	11th	53.2	14th	73.9	83.1	11th	66.2	29th	90	44	70	22	14th	94.0	9th	31	31	30	26	19
Sep	62.3	76.6	14th	41.6	29th	67.2	77.5	14th	48.4	30th	86	44	67	23	25th	88.5	23rd	24	19	14	1	0
Oct	56.7	71.7	4th	34.1	29th	61.8	75.7	23rd	39.9	30th	86	47	69	26	14th	85.2	9th	16	8	1	0	0
Nov	40.2	64.0	26th	20.6	16th	47.6	66.1	1st	26.1	18th	88	36	62	16	6th	76.8	6th	0	0	0	0	0
Dec	43.0	66.6	12th	14.2	4th	47.9	67.4	13th	22.0	19th	93	49	75	15	5th	75.5	9th	0	0	0	0	0
Year	51.4	80.8	9-Jul	8.9	29-Jan	57.2	83.1	11-Aug	19.3	17-Feb	88	41	67	15	23-Feb	94.0	9-Aug	162	111	82	46	22

Table 1(c) - Means and Extremes of SRS Meteorological Data for 2007 (cont'd)

Month	Wind Speed (mph)				Barometric Pressure (mb)					Solar Radiation (ly/day)						Degree Days					
	Monthly Average	Max 15-min Average	Max Instantaneous	Date Max Inst.	Average	Lowest	Low Date	Highest	High Date	Average Daily Total	% of Theoretical Max	Minimum Daily Total	Date	Maximum Daily Total	Date	Heating Degree Days	Daily maximum	Date	Cooling Degree Days	Daily Maximum	Date
Jan	4.5	19.4	39.5	9th	1010.9	996.2	28th	1025.2	11th	219	0.61	48	7th	382	31st	510	31	29th	3	3	5th
Feb	4.5	17.4	40.5	13th	1006.6	990.8	14th	1020.4	6th	332	0.74	36	1st	483	26th	521	31	17th	0	0	
Mar	4.0	15.5	38.5	2nd	1010.6	987.5	2nd	1020.7	21st	408	0.72	65	1st	567	18th	220	22	5th	15	5	25th
Apr	5.0	20.5	44.4	15th	1003.9	983.9	15th	1016.1	23rd	526	0.77	181	15th	667	29th	153	24	8th	57	9	27th
May	4.3	13.0	31.4	7th	1006.8	999.5	12th	1018.4	24th	551	0.73	117	5th	713	19th	10	5	7th	170	11	31st
Jun	4.0	16.8	39.4	4th	1004.5	986.1	3rd	1015.3	26th	544	0.69	99	2nd	700	9th	0	0		344	18	24th
Jul	3.6	14.3	38.9	11th	1004.9	997.8	30th	1011.2	4th	474	0.62	129	2nd	669	24th	0	0		386	17	20th
Aug	3.4	10.6	28.5	13th	1004.6	996.5	10th	1011.3	19th	482	0.68	257	31st	605	10th	0	0		525	25	10th
Sep	4.1	12.7	27.2	22nd	1007.7	1000.6	27th	1017.9	30th	429	0.70	106	20th	573	3rd	0	0		305	16	11th
Oct	3.9	11.5	25.7	29th	1006.8	995.3	19th	1021.0	29th	332	0.66	61	24th	514	1st	44	10	30th	160	12	10th
Nov	3.7	18.8	36.4	15th	1009.3	997.8	15th	1018.7	24th	279	0.70	50	26th	403	3rd	329	23	8th	2	1	22nd
Dec	3.8	19.5	34.7	16th	1009.4	991.0	16th	1019.9	18th	214	0.65	32	30th	326	17th	395	30	18th	1	1	12th
Year	4.1	20.5	44.4	15-Apr	1007.2	983.9	15-Apr	1025.2	11-Jan	399	0.69	32	30-Dec	713	19-May	2183	31	17-Feb	1966	25	10-Aug

Table 2. Monthly and Annual Average and Extreme Temperatures, 1977-2007

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1977	35.3	47.1	60.0	66.9	73.3	80.6	83.6	80.6	77.9	62.1	58.2	46.7	64.4
1978	39.3	41.3	54.2	65.7	70.9	79.7	82.1	81.2	77.1	65.6	60.7	49.6	64.0
1979	42.1	44.6	57.5	64.5	71.3	75.1	79.6	80.5	73.4	64.8	57.4	47.4	63.2
1980	45.9	44.3	52.6	63.5	71.2	78.3	83.8	82.5	79.2	62.7	52.8	46.0	63.6
1981	40.4	48.5	53.0	67.0	68.6	81.3	81.3	76.3	74.0	62.1	54.4	43.2	62.5
1982	43.0	50.0	58.9	62.4	75.7	78.8	80.9	80.1	75.0	66.2	58.7	54.8	65.4
1983	43.3	48.0	55.3	59.4	66.8	76.7	84.3	83.9	74.8	67.2	56.4	45.8	63.5
1984	45.0	51.7	56.5	62.6	71.9	80.1	80.1	80.8	74.0	73.4	53.4	56.9	65.5
1985	42.9	49.5	60.2	67.5	74.5	80.8	81.1	79.7	75.7	70.8	65.5	45.4	66.1
1986	45.4	54.6	57.9	66.4	74.4	82.7	86.9	80.1	78.4	67.1	61.3	49.3	67.0
1987	46.2	48.6	56.5	62.3	74.5	79.9	82.8	83.8	76.6	60.7	59.1	52.9	65.3
1988	42.3	47.8	56.8	64.2	70.4	76.8	81.6	81.4	75.4	61.2	58.0	49.1	63.8
1989	52.2	52.0	58.3	64.2	70.6	79.8	81.4	80.9	75.3	67.3	52.4	44.2	64.9
1990	54.9	57.5	60.0	64.0	72.9	80.5	83.7	83.8	79.0	69.4	59.9	54.6	68.4
1991	47.9	54.1	60.3	69.2	76.9	79.5	83.6	81.2	77.4	68.1	55.4	54.0	67.3
1992	49.5	54.1	57.2	65.0	71.2	78.9	83.7	80.7	76.9	65.0	57.1	48.0	65.6
1993	51.7	47.8	53.2	58.9	69.7	78.2	83.6	80.0	75.2	62.8	55.2	43.6	63.3
1994	41.5	50.1	60.2	68.0	71.2	82.3	81.8	81.2	77.4	67.2	62.3	53.3	66.4
1995	45.5	49.9	58.6	65.9	73.5	75.0	79.9	79.0	71.8	65.9	50.8	43.8	63.3
1996	44.6	50.1	50.6	61.6	72.9	76.5	79.3	76.0	72.7	62.1	51.6	48.8	62.2
1997	48.2	52.9	63.3	61.2	68.5	74.0	80.2	79.0	75.0	64.1	51.6	47.0	63.8
1998	49.7	51.1	53.6	62.7	74.6	82.1	82.6	80.3	75.8	66.9	60.5	53.6	66.1
1999	51.9	51.6	53.4	67.2	69.7	76.6	80.7	82.9	73.8	64.3	58.1	48.6	64.9
2000	44.4	50.2	58.5	60.7	75.1	78.0	79.9	77.6	71.7	62.5	53.1	38.2	62.5
2001	43.8	52.4	53.0	63.9	71.3	75.3	77.7	78.8	71.2	62.2	60.0	52.4	63.5
2002	47.3	48.0	57.6	68.1	70.2	77.5	80.5	78.4	75.4	66.7	51.7	44.5	63.8
2003	42.0	47.5	57.6	61.6	70.6	75.2	77.3	77.7	71.9	63.7	58.2	42.9	62.2
2004	43.7	45.2	58.5	63.4	74.0	77.7	80.1	77.3	73.2	66.2	56.1	45.8	63.4
2005	47.9	49.0	53.1	60.9	68.0	75.4	79.4	78.8	77.0	64.7	56.1	44.3	62.9
2006	50.8	47.3	55.3	66.3	70.1	76.2	80.3	80.5	72.9	62.4	53.6	50.6	63.8
2007	48.6	46.4	58.4	61.8	70.2	76.5	77.4	81.9	75.2	68.7	54.0	52.3	64.3

Avg	45.7	49.5	56.8	64.1	71.8	78.3	81.3	80.2	75.2	65.3	56.6	48.3	64.4
Lowest Mon	35.3	41.3	49.5	58.9	66.8	74.0	77.3	74.5	70.5	60.1	48.7	38.2	62.2
Yr Lowest	1977	1978	1971	1993	1983	1997	2003	1973	1973	1976	1976	2000	2003
Rec Low	-3	10	11	26	38	48	56	56	41	28	18	5	-3
Yr Rec	1985	1996	1980	2007	1989	1984	1963	1986	1967	1976	1970	1962	1985
Highest Mon	59.6	57.5	63.3	69.2	76.9	82.7	86.9	83.9	79.2	73.4	65.5	56.9	68.4
Yr Highest	1974	1990	1997	1991	1991	1986	1986	1983	1980	1984	1985	1971	1990
Rec High	86	86	90	99	102	105	107	107	104	96	89	82	107
Yr Rec	1975	1989	1974	1986	1963	1985	1986	1983	1990	1986	19874	1984	1986

Table 3. Monthly and Annual Rainfall, 1977-2007

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1977	3.72	1.62	6.86	1.27	1.79	2.47	3.42	7.30	5.50	4.27	1.63	3.86	43.71
1978	10.02	1.31	3.06	3.53	3.64	3.42	4.11	5.10	4.06	0.06	3.54	1.87	43.72
1979	3.59	7.74	3.09	6.49	8.94	1.54	7.85	2.12	6.13	1.35	3.95	2.17	54.96
1980	5.12	3.48	10.96	1.69	3.49	2.99	0.90	2.03	5.86	2.14	2.50	1.91	43.07
1981	0.89	5.02	4.72	2.07	6.90	4.29	3.96	5.79	0.54	2.81	1.00	9.55	47.54
1982	3.94	4.46	2.51	5.68	2.73	4.28	11.49	5.02	4.62	3.87	2.41	4.85	55.86
1983	3.75	7.22	6.62	5.77	1.67	6.57	4.85	6.32	3.56	1.92	5.39	4.15	57.79
1984	3.51	7.09	6.05	8.00	9.79	2.54	7.28	5.52	0.60	0.31	0.90	1.38	52.97
1985	3.01	6.92	1.31	0.84	1.70	4.62	8.10	4.38	0.49	6.34	6.36	2.48	46.55
1986	1.46	3.58	4.08	1.45	3.84	3.03	2.96	10.90	1.54	4.19	5.82	5.83	48.68
1987	7.39	7.55	4.97	0.70	3.57	5.64	4.87	4.93	3.56	0.29	2.74	1.42	47.63
1988	4.15	3.19	2.91	4.78	2.85	7.12	1.78	6.80	4.40	3.39	2.17	2.91	46.45
1989	1.42	3.59	5.52	4.89	2.60	6.67	11.46	3.27	4.87	3.36	3.00	4.41	55.06
1990	3.07	2.38	2.37	1.21	2.95	0.89	7.31	8.07	0.62	19.62	1.41	1.57	51.47
1991	7.03	1.84	7.89	4.73	3.06	2.17	7.89	9.26	4.40	0.99	1.55	3.32	54.13
1992	4.45	3.89	2.98	2.40	1.34	6.27	3.69	4.83	6.38	3.11	7.78	2.86	49.98
1993	7.45	3.62	8.37	1.74	1.43	3.27	3.12	2.23	7.29	0.99	1.87	1.81	43.19
1994	4.80	3.91	6.42	1.05	1.45	5.08	7.47	3.47	0.99	10.01	3.05	4.62	52.32
1995	6.96	7.97	0.92	1.28	1.77	8.15	5.71	6.92	5.75	2.64	2.38	4.47	54.92
1996	3.65	2.43	6.64	2.40	2.96	3.04	5.57	6.91	3.67	2.16	2.32	3.20	44.95
1997	4.20	5.45	2.69	4.38	2.38	6.90	7.09	2.01	4.89	4.08	5.51	9.09	58.67
1998	7.73	8.90	6.69	7.35	4.05	4.65	5.27	2.88	4.81	0.78	0.82	1.80	55.73
1999	5.31	2.29	3.44	1.95	1.26	7.52	4.91	3.14	4.46	2.57	1.50	1.21	39.56
2000	5.77	0.73	3.95	1.34	1.36	4.74	2.47	4.49	7.70	0.02	3.50	1.53	37.60
2001	3.11	2.68	7.21	1.28	3.85	6.49	4.79	3.55	3.33	0.50	1.03	0.54	38.36
2002	2.85	2.13	3.86	2.58	1.69	2.30	5.95	5.47	3.45	3.19	4.00	3.58	41.05
2003	1.73	5.00	7.09	8.43	5.57	10.99	8.91	4.59	2.70	3.03	1.21	1.93	61.18
2004	2.85	6.71	0.81	1.34	3.45	6.41	1.23	2.96	10.26	1.02	3.17	2.69	42.90
2005	2.14	3.89	6.09	1.69	2.87	8.23	5.81	4.08	0.19	3.60	2.67	6.16	47.42
2006	3.38	2.90	1.76	2.41	1.83	6.89	5.22	2.19	2.50	1.66	2.98	4.56	38.28
2007	3.27	3.60	1.98	2.95	1.23	4.83	4.57	2.66	0.97	1.35	0.55	8.79	36.75

Avg	4.25	4.29	4.64	3.15	3.16	4.97	5.48	4.81	3.87	3.08	2.86	3.57	48.14
Min	0.89	0.73	0.81	0.60	1.23	0.89	0.90	1.04	0.19	0.00	0.21	0.46	28.82
Yr Min	1981	2000	2004	1972	2007	1990	1980	1963	2005	1963	1958	1955	1954
Max	10.02	8.90	10.96	8.43	10.90	12.97	13.71	12.34	10.26	19.62	7.78	9.55	73.47
Yr Max	1978	1998	1980	2003	1976	1973	1971	1964	2004	1990	1992	1981	1964

Table 4 - SRS Rainfall (in inches) for 2007, Manual Gauges

Month	700-A	Barricade 2	Barricade 3	Barricade 5	100-C	400-D	200-F	200-H	100-K	100-L	100-P	SRNL
Jan	4.15	6.11	3.16	3.29	3.44	3.18	4.10	4.03	3.76	5.50	4.55	3.66
Feb	2.51	2.80	2.44	2.60	3.50	2.87	2.75	3.02	3.95	3.13	3.33	2.70
Mar	2.02	2.12	1.84	1.85	1.81	1.70	2.35	2.40	1.86	1.65	1.07	2.14
Apr	2.13	2.87	3.68	3.69	2.83	2.48	3.70	2.93	2.69	2.47	3.65	2.29
May	0.63	1.16	2.49	2.16	1.26	1.23	2.47	2.15	1.18	0.92	0.98	1.04
Jun	4.42	4.83	5.42	5.35	6.02	5.42	5.98	6.42	6.39	5.67	5.15	5.04
Jul	4.95	6.24	9.43	5.13	3.83	4.97	4.68	6.72	7.88	5.78	3.79	5.49
Aug	2.69	4.01	3.90	4.20	3.37	3.04	3.34	1.41	2.34	2.78	1.52	4.08
Sep	2.13	3.14	1.17	2.06	0.98	0.91	1.04	1.90	3.53	1.13	1.63	2.30
Oct	1.76	2.81	1.08	1.24	1.84	1.47	1.80	1.91	1.40	1.52	3.09	1.42
Nov	0.42	0.47	0.26	0.40	0.62	0.14	0.45	0.43	0.50	0.62	0.62	0.48
Dec	6.97	8.13	9.08	8.13	7.42	9.67	7.75	9.14	9.73	8.57	8.35	8.05
Annual	34.78	44.69	43.95	40.10	36.92	37.08	40.41	42.46	45.21	39.74	37.73	38.69

Fig. 1 SRS Meteorological Monitoring Network

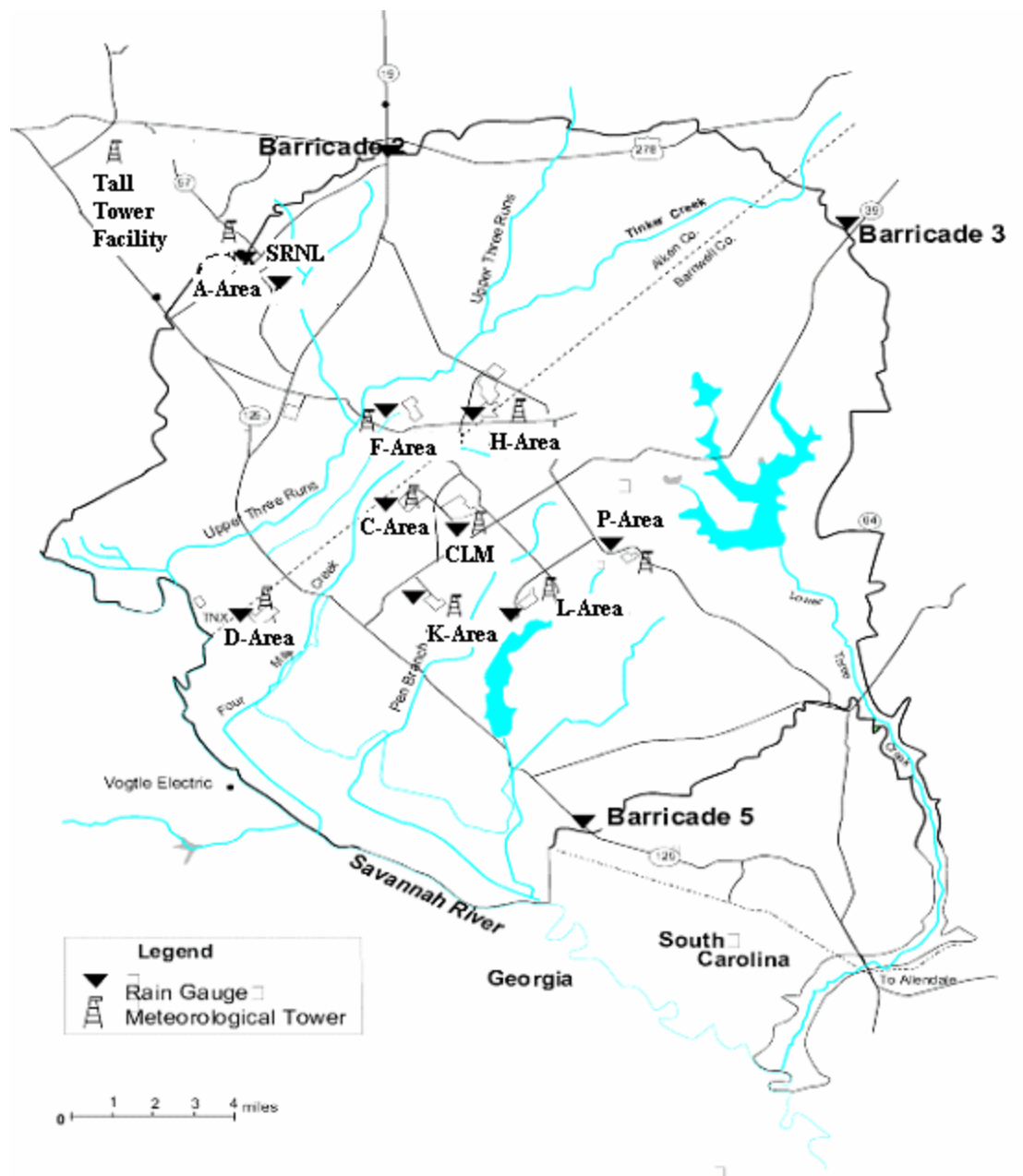


Fig. 2 - Summary of Daily Data for 2007

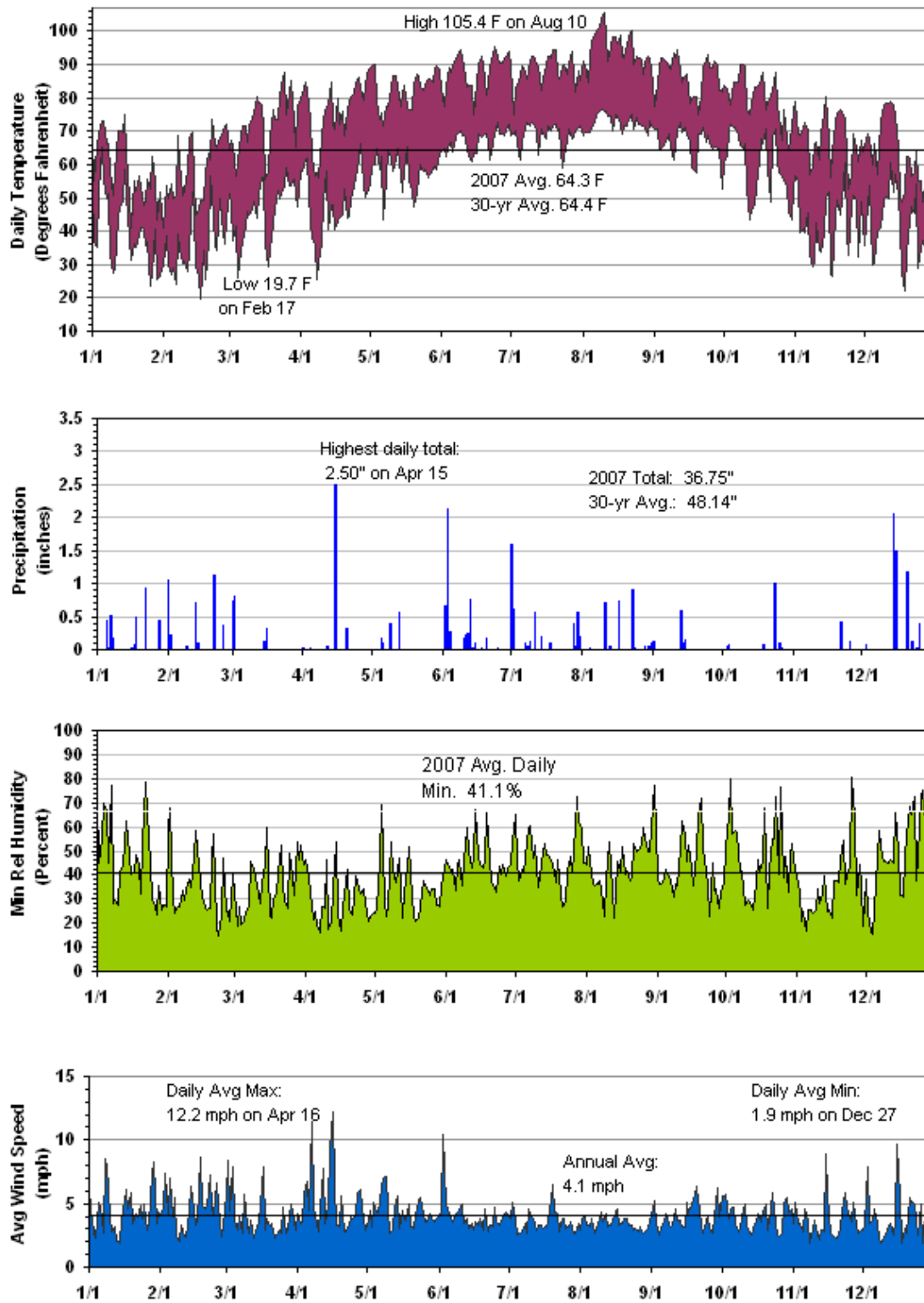


Fig. 3 - Daily High and Low Temperatures for 2007

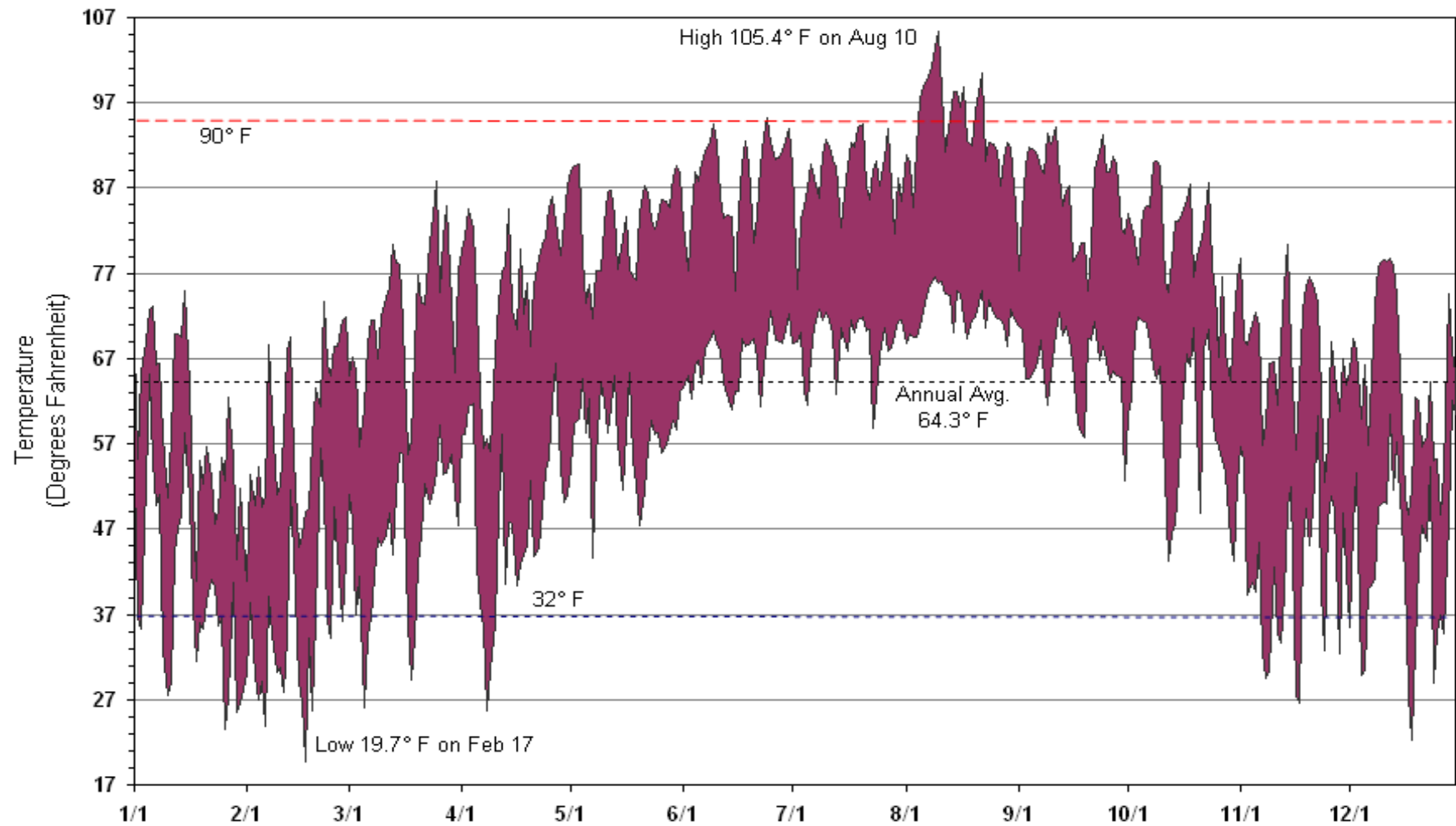


Fig. 4 - SRS Annual Average Temperature 1977-2007

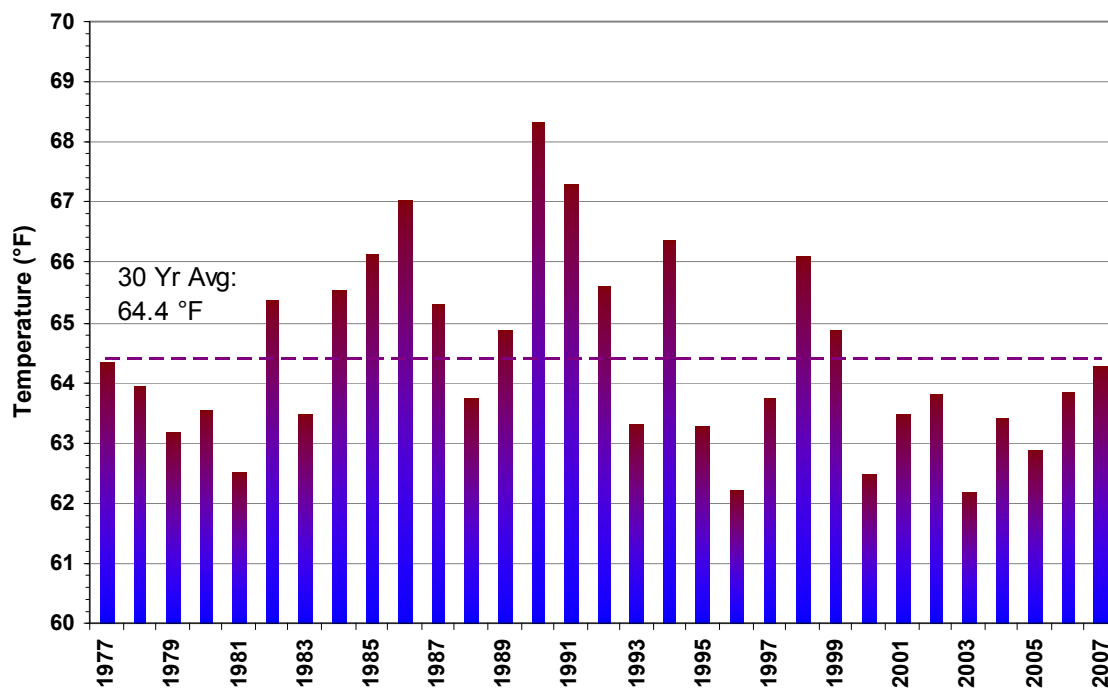


Fig. 5 - SRS Monthly Average Temperature

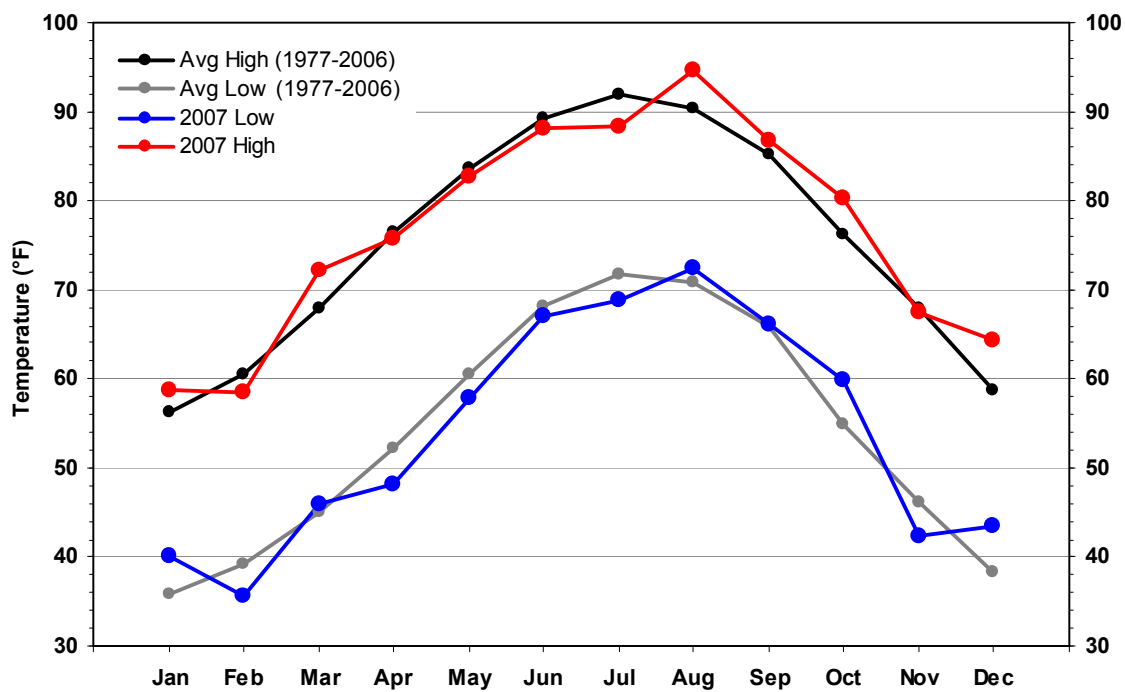


Fig. 6 - Number of Freezing (<32 F) and Sweltering (>90 F) Days

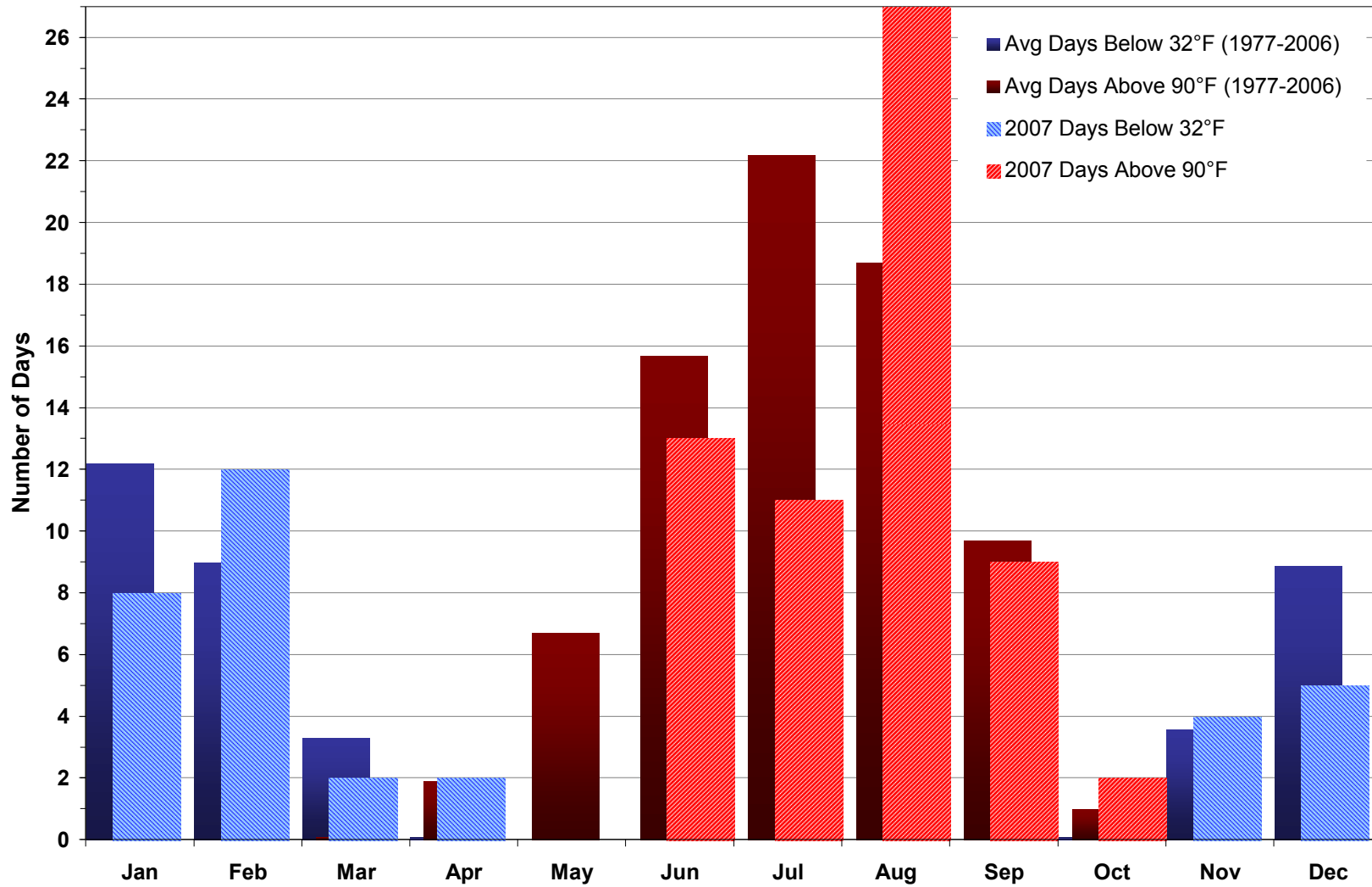


Fig. 7 - Daily Precipitation for 2007

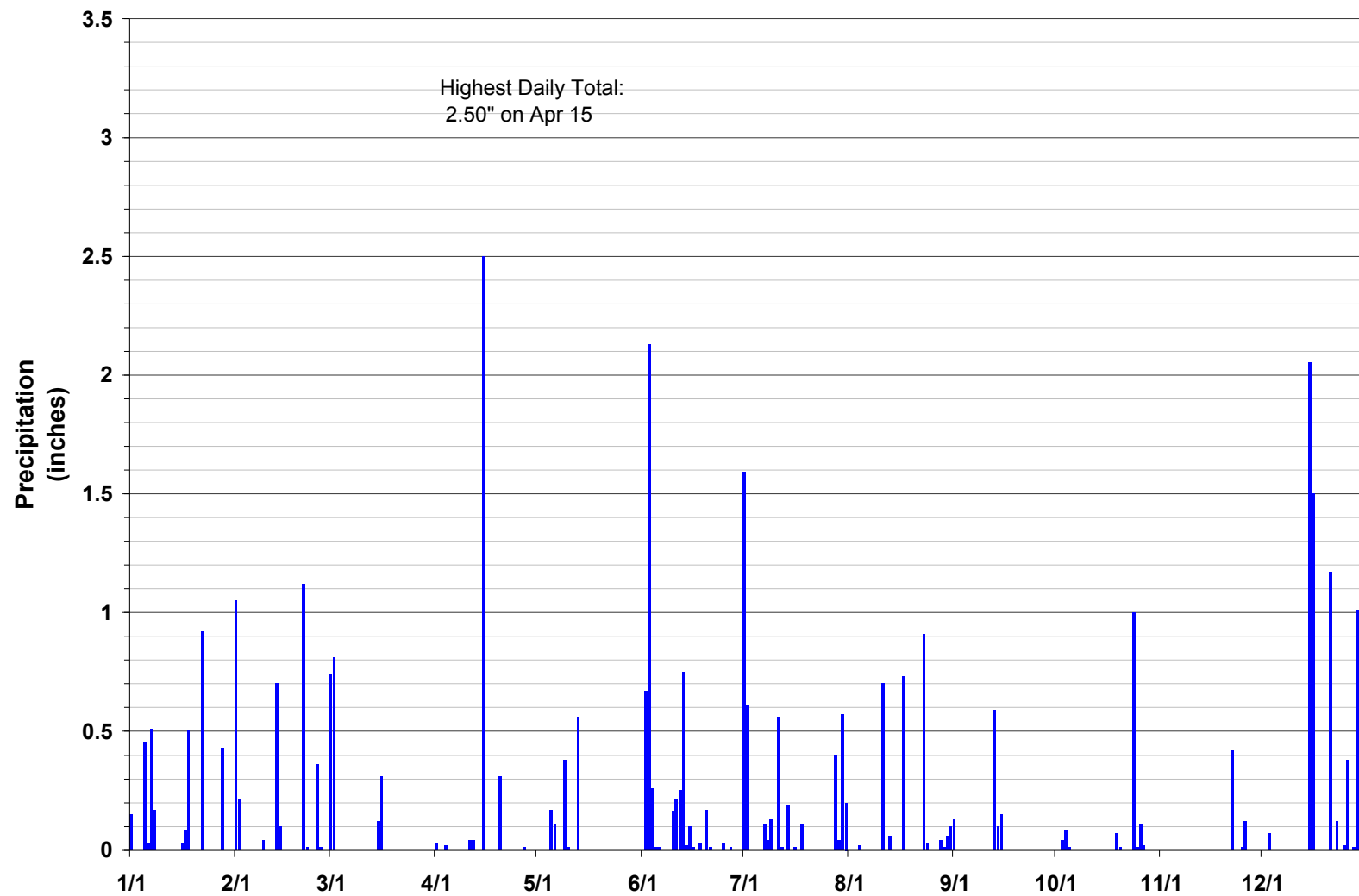


Fig. 8 - SRS Annual Precipitation 1977-2007

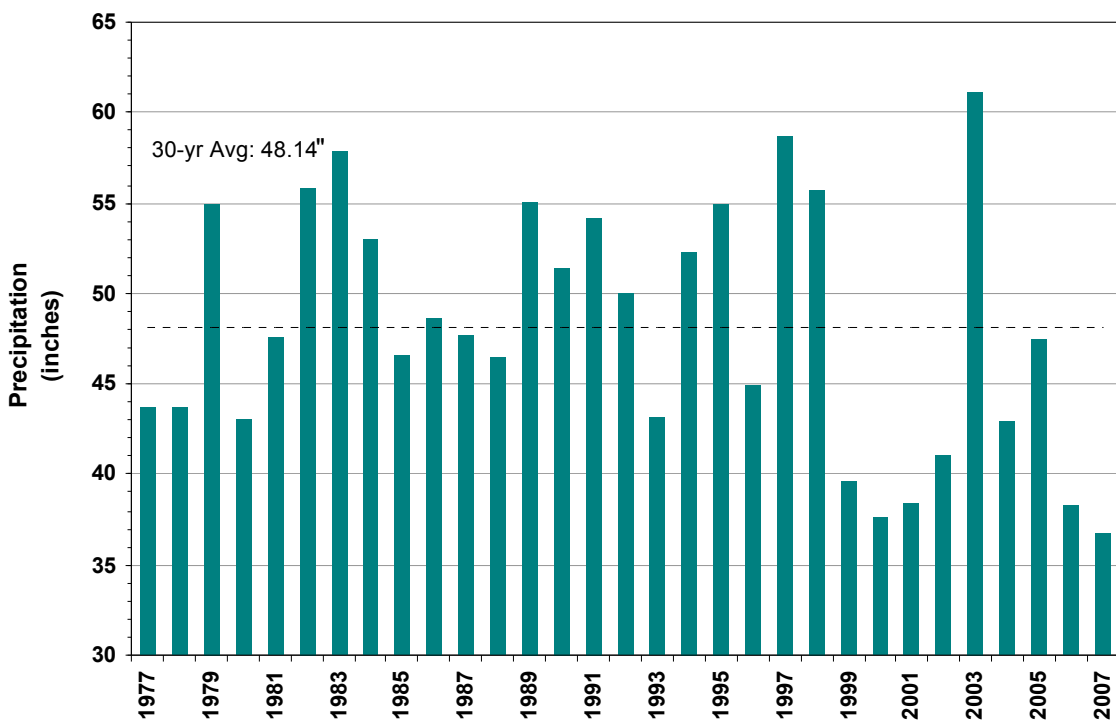


Fig. 9 - SRS Monthly Precipitation

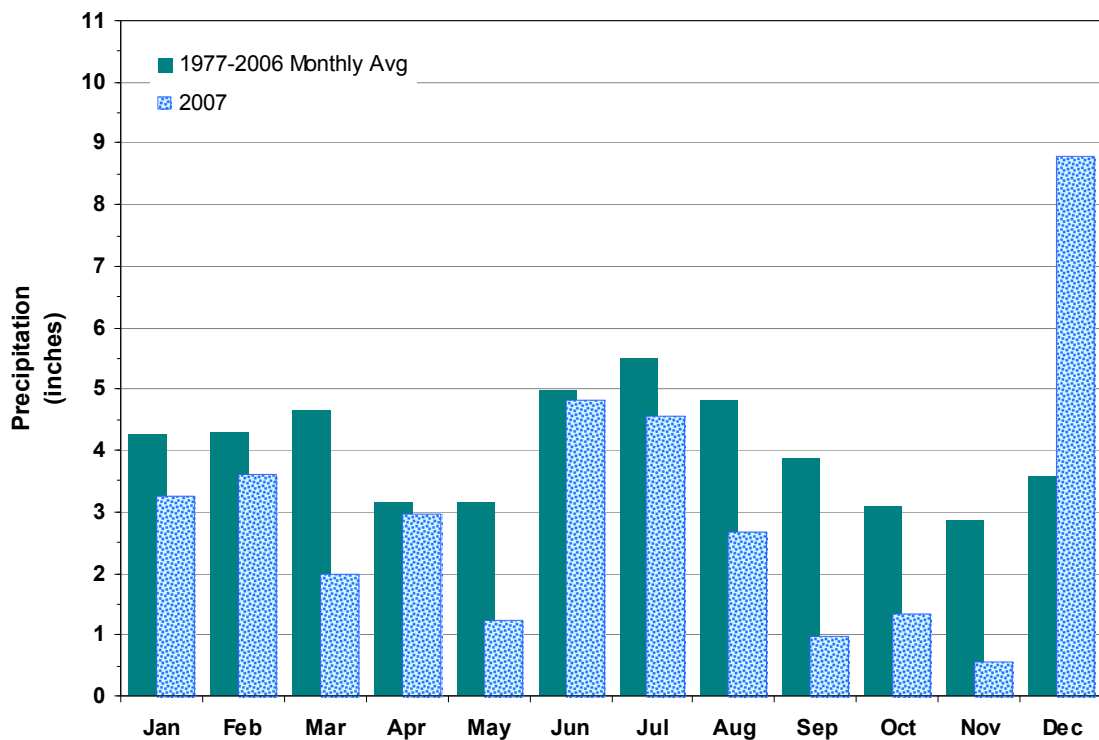


Fig. 10 - Daily High and Low Humidity for 2007

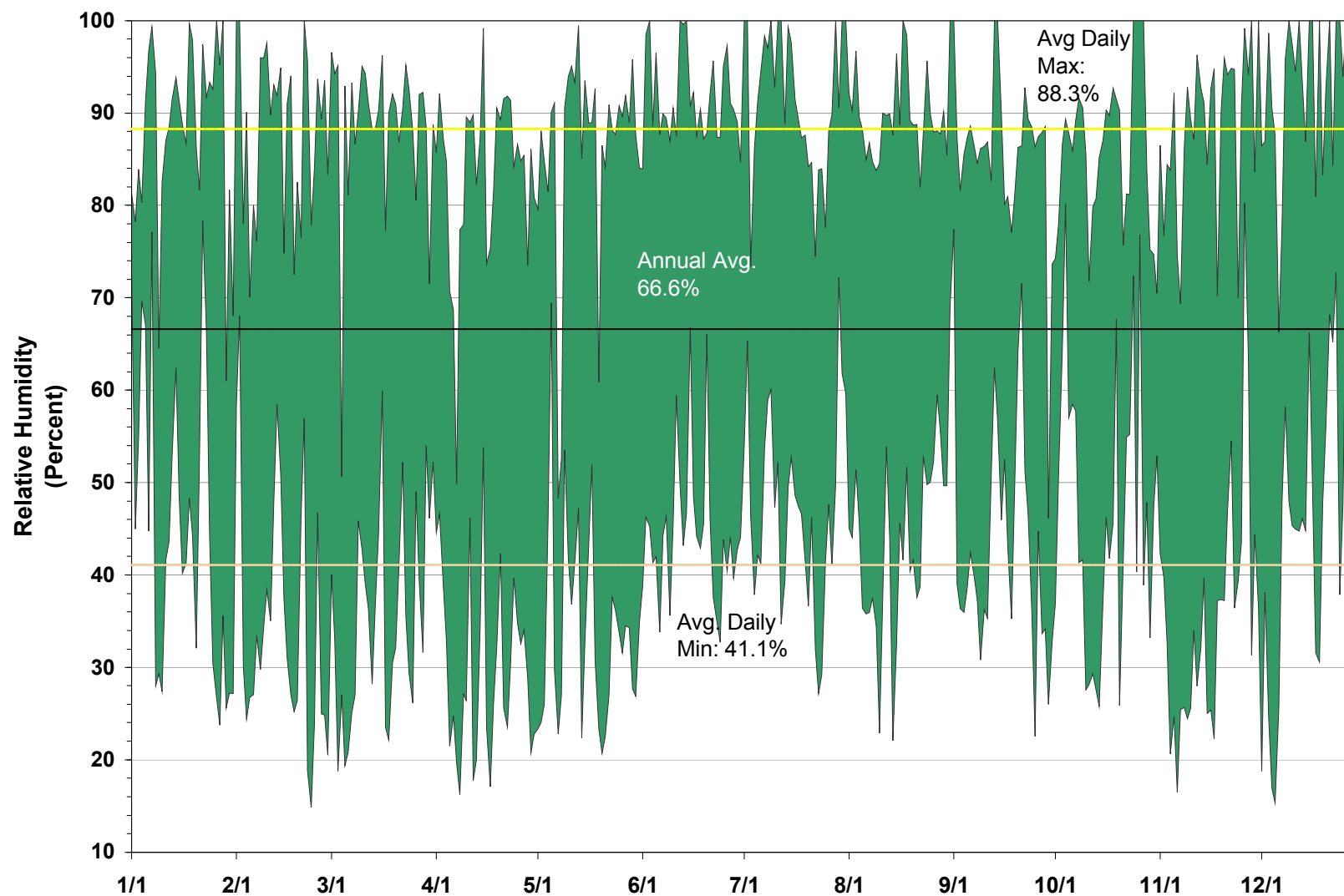


Fig. 11 - SRS Annual Average Humidity 1977-2007

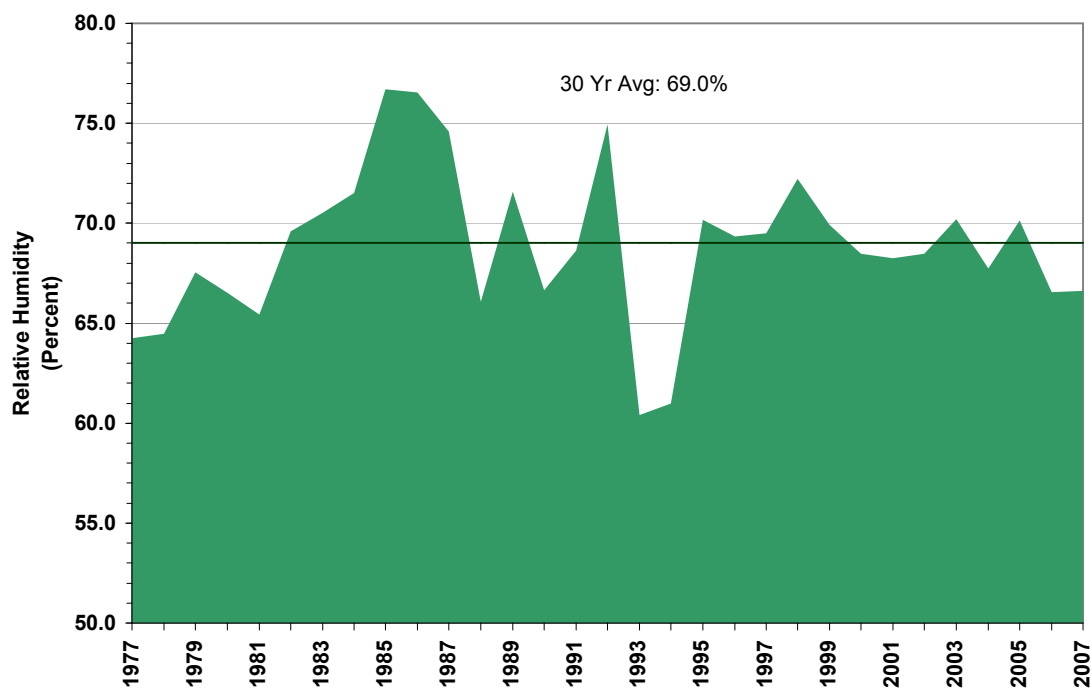


Fig. 12 - SRS Monthly Average Minimum Humidity

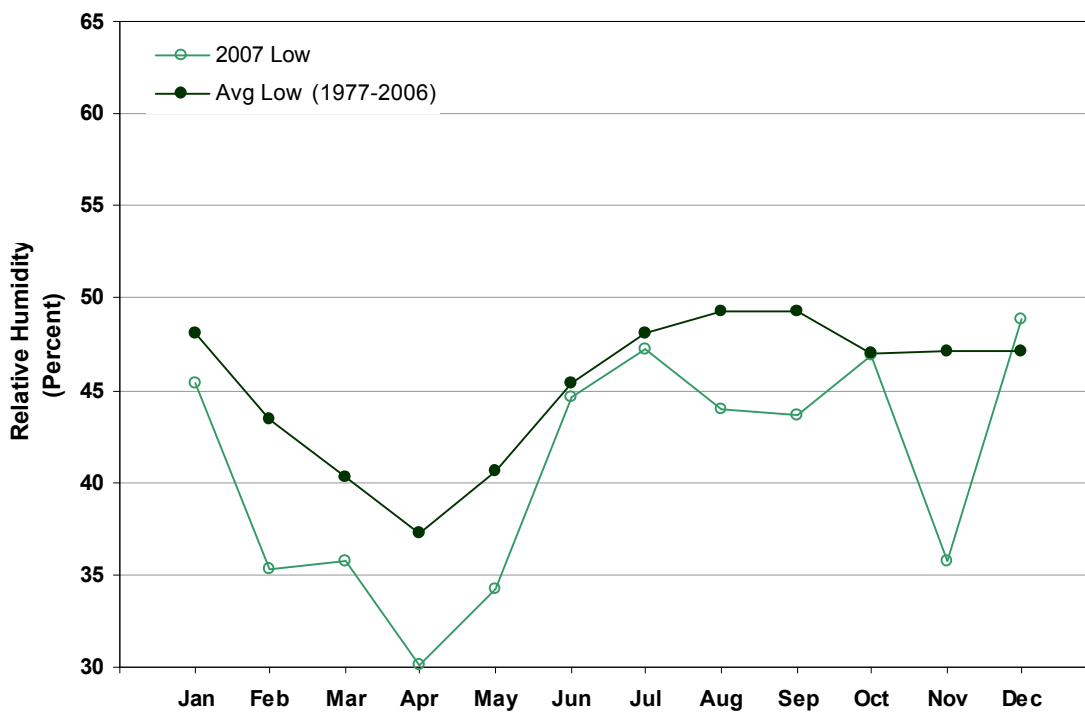


Fig. 13 - Daily Average Wind Speed for 2007

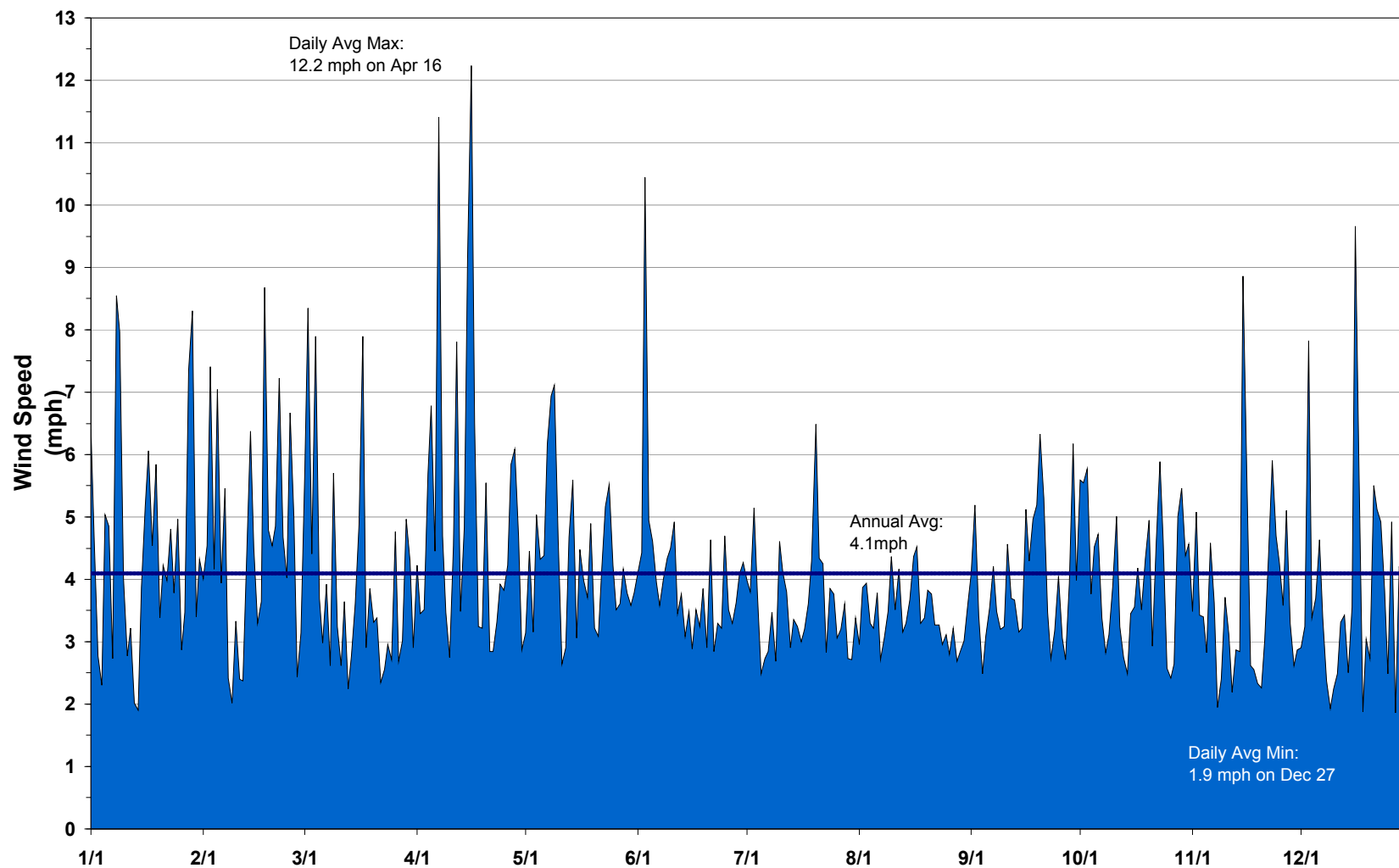
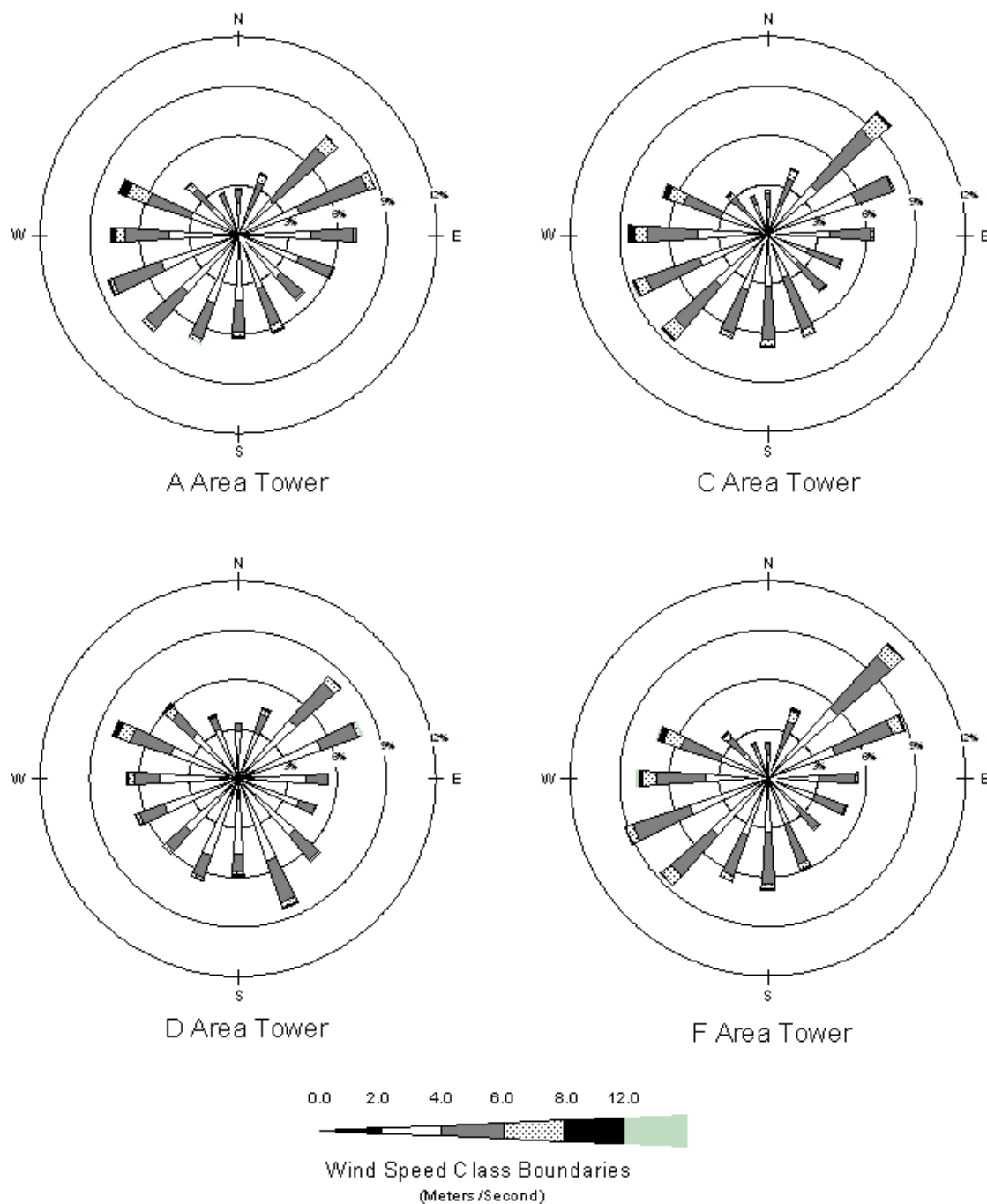
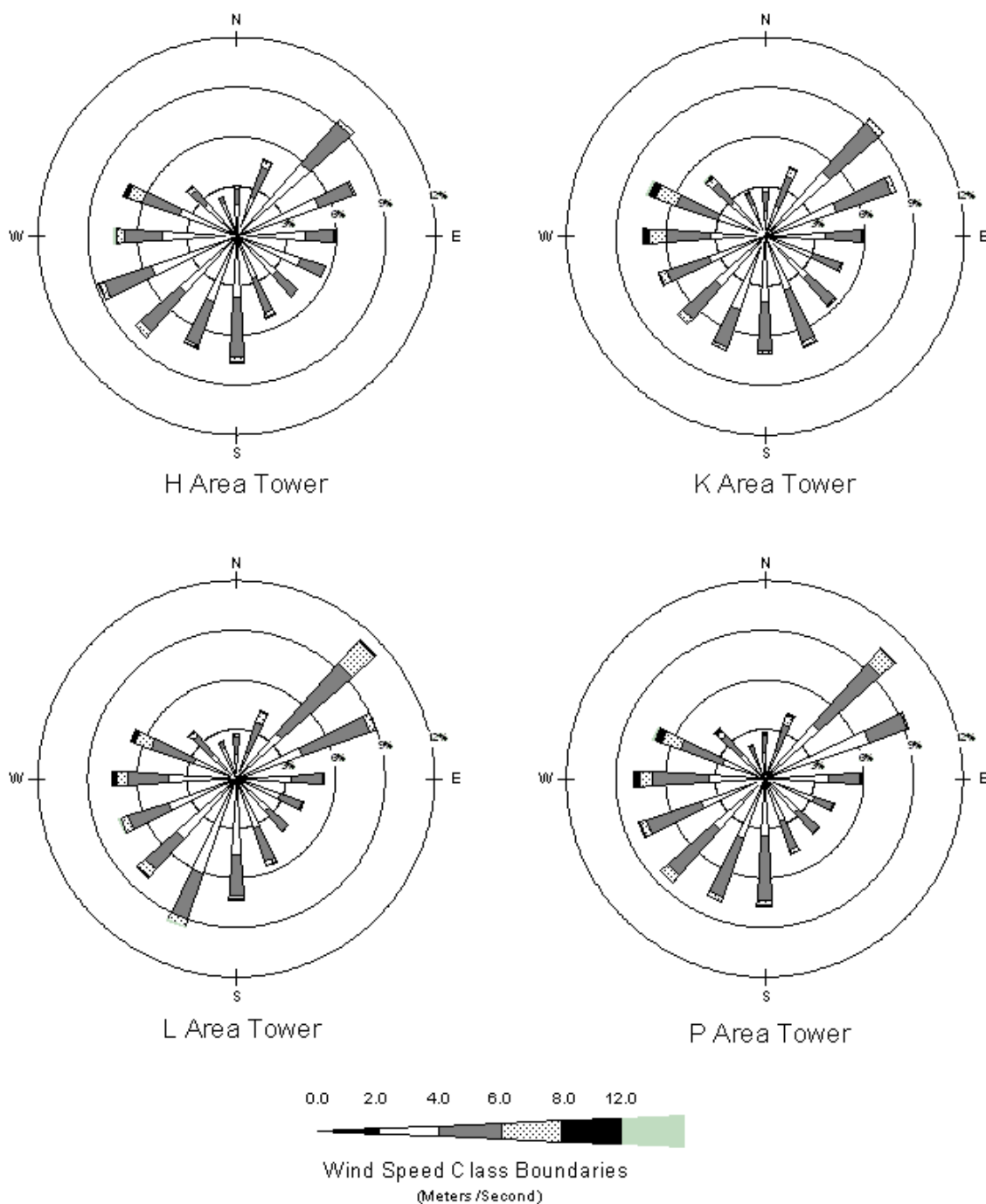


Fig. 14(a) - Annual Wind Rose Plots for 2007, 61-m Level



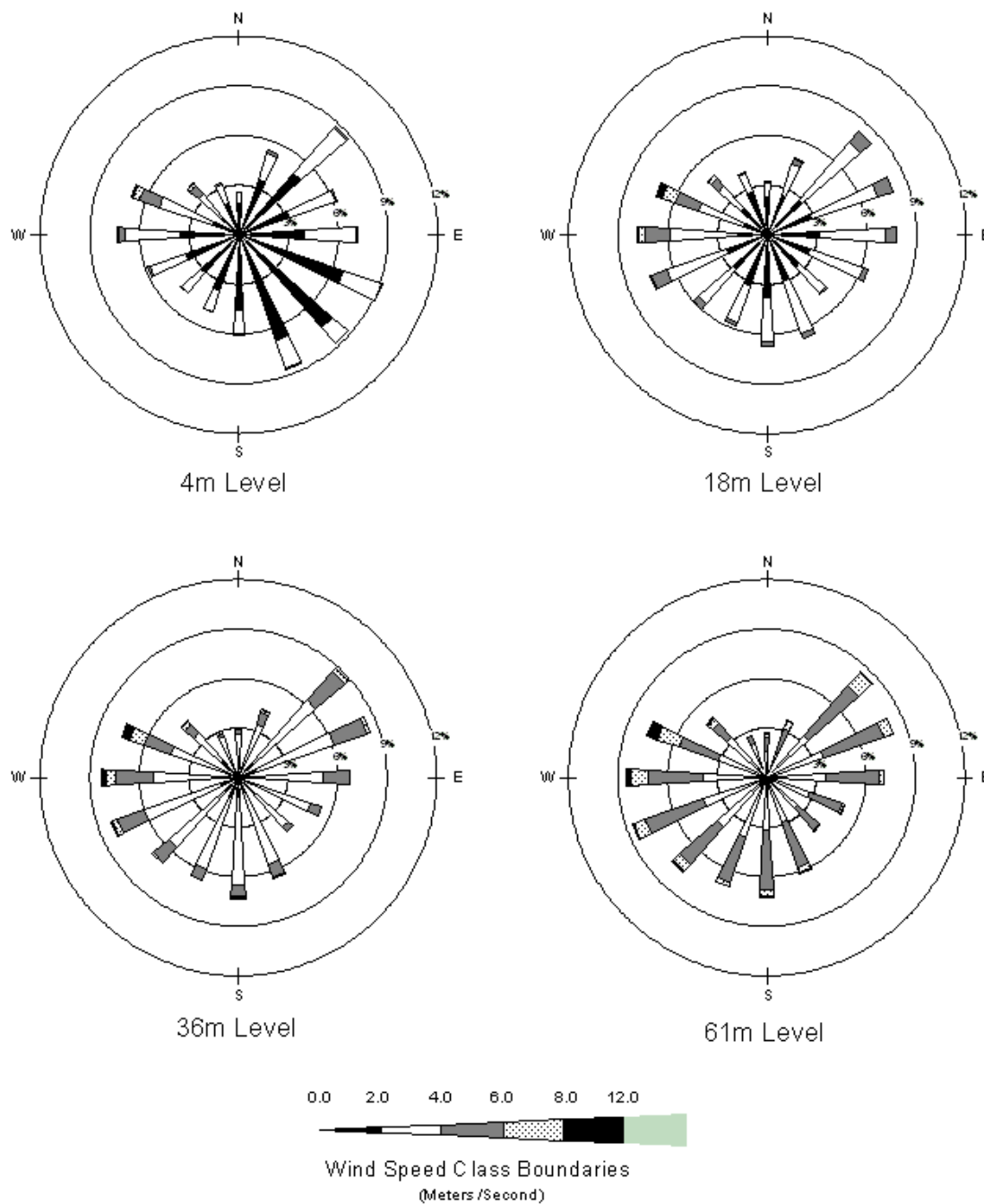
Windrose plot depicts the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category

Fig. 14(b) - Annual Wind Rose Plots for 2007, 61-m Level



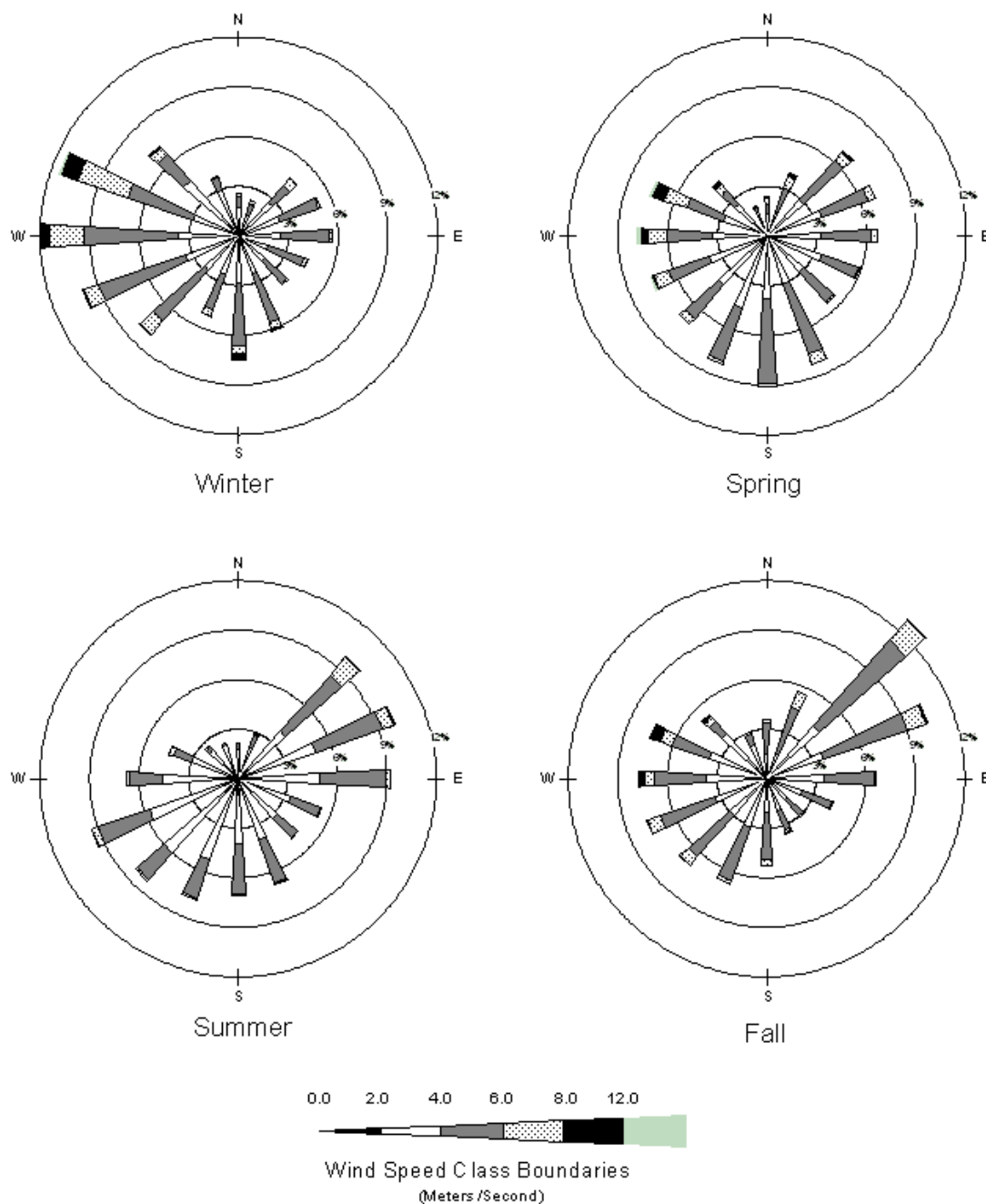
Windrose plot depicts the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category

Fig. 15 - Annual Wind Rose Plots for 2007, Central Climatology, All Levels



Windrose plot depicts the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category

Fig. 16 - Seasonal Wind Rose Plots for 2007,
Central Climatology, 61-m Level



Windrose plot depicts the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category

Fig. 17 - Daily Average Barometric Pressure for 2007

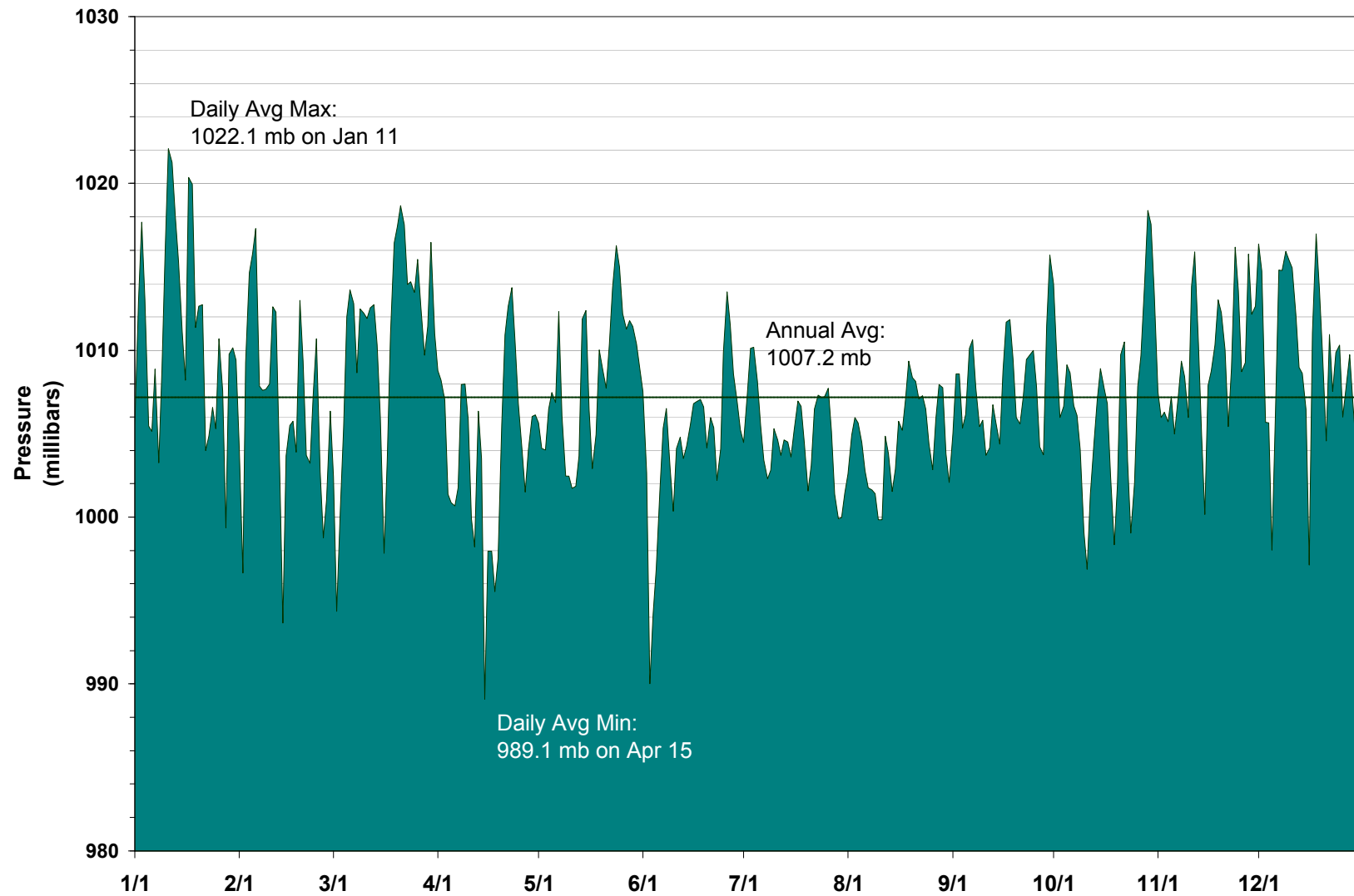
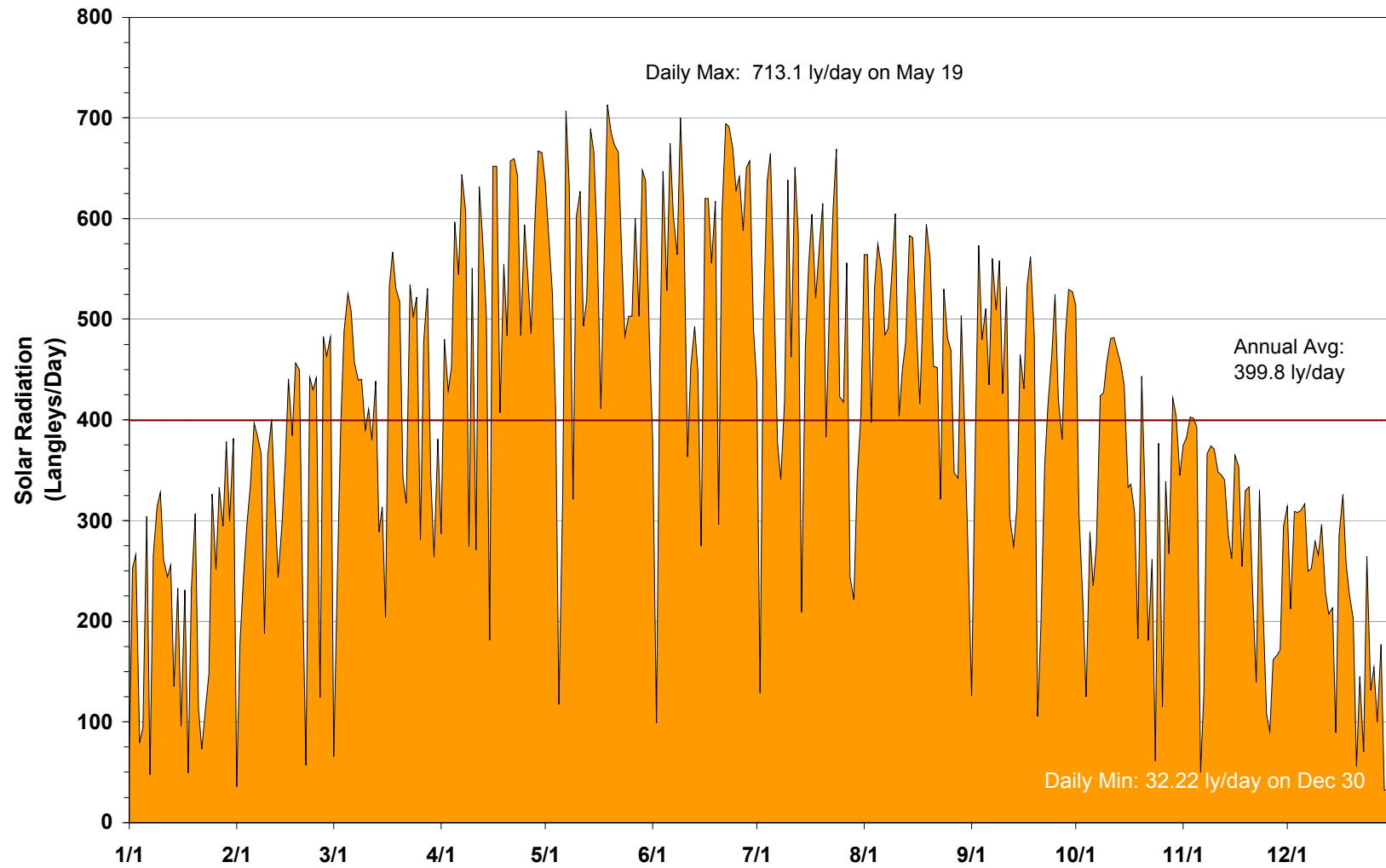


Fig. 18 - Daily Solar Radiation for 2007



**Table A.1 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the A Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.004318	0.015358	0.007207	0.001430	0.000000	0.000000	0.028313
NNE	0.004061	0.012240	0.017446	0.004862	0.000686	0.000000	0.039295
NE	0.004776	0.023280	0.042470	0.009152	0.000400	0.000000	0.080078
ENE	0.005663	0.033776	0.042699	0.004747	0.000229	0.000000	0.087114
E	0.006521	0.036836	0.026426	0.001173	0.000000	0.000000	0.070956
ESE	0.005806	0.033204	0.020792	0.000915	0.000000	0.000000	0.060717
SE	0.006263	0.028199	0.016874	0.001573	0.000172	0.000000	0.053081
SSE	0.006807	0.027512	0.023080	0.004118	0.001316	0.000000	0.062833
S	0.006749	0.032775	0.018875	0.002746	0.001058	0.000086	0.062289
SSW	0.005949	0.038266	0.022307	0.002889	0.000057	0.000029	0.069497
SW	0.006664	0.039839	0.028628	0.002603	0.000114	0.000029	0.077877
WSW	0.007750	0.041841	0.031116	0.002460	0.000315	0.000000	0.083482
W	0.006864	0.035349	0.026940	0.005834	0.002031	0.000257	0.077275
WNW	0.005062	0.025825	0.027427	0.013299	0.004919	0.000200	0.076732
NW	0.003832	0.018303	0.015444	0.004147	0.001287	0.000029	0.043042
NNW	0.003604	0.015100	0.008065	0.000486	0.000172	0.000000	0.027427
Total	0.090689	0.457703	0.375796	0.062434	0.012756	0.000630	1.000008

**Table A.2 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the C Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.003919	0.012672	0.008210	0.001516	0.000315	0.000000	0.026632
NNE	0.004176	0.014045	0.017392	0.006093	0.001116	0.000000	0.042822
NE	0.007380	0.032066	0.045482	0.013502	0.000973	0.000000	0.099403
ENE	0.007781	0.049000	0.022941	0.001487	0.000029	0.000000	0.081238
E	0.005349	0.031980	0.025373	0.001630	0.000000	0.000000	0.064332
ESE	0.004834	0.020596	0.021168	0.001516	0.000000	0.000000	0.048114
SE	0.005292	0.019194	0.021540	0.000944	0.000086	0.000000	0.047056
SSE	0.006036	0.022026	0.033582	0.004548	0.000687	0.000086	0.066965
S	0.006408	0.024800	0.033296	0.003118	0.000944	0.000057	0.068623
SSW	0.006493	0.030121	0.027404	0.003032	0.000114	0.000000	0.067164
SW	0.006894	0.035556	0.033925	0.008839	0.001030	0.000000	0.086244
WSW	0.006665	0.037558	0.033983	0.007294	0.001802	0.000315	0.087617
W	0.006779	0.035613	0.030664	0.007952	0.003890	0.000486	0.085384
WNW	0.004577	0.025544	0.024228	0.009840	0.004319	0.000343	0.068851
NW	0.003261	0.014674	0.012643	0.002775	0.001344	0.000000	0.034697
NNW	0.004891	0.014016	0.005435	0.000515	0.000000	0.000000	0.024857
Total	0.090735	0.419461	0.397266	0.074601	0.016649	0.001287	0.999999

**Table A.3 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the D Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.011044	0.017910	0.004234	0.000658	0.000057	0.000000	0.033903
NNE	0.008412	0.021143	0.012074	0.003347	0.000315	0.000000	0.045291
NE	0.010786	0.036307	0.030814	0.004692	0.000458	0.000000	0.083057
ENE	0.010615	0.042945	0.022974	0.002804	0.000086	0.000029	0.079453
E	0.010014	0.031071	0.013218	0.000801	0.000000	0.000000	0.055104
ESE	0.010185	0.029011	0.010729	0.000429	0.000057	0.000000	0.050411
SE	0.009670	0.036307	0.019541	0.001373	0.000029	0.000000	0.066920
SSE	0.010986	0.042086	0.026150	0.003634	0.001001	0.000000	0.083857
S	0.012274	0.033074	0.010529	0.002203	0.001059	0.000172	0.059311
SSW	0.011902	0.037652	0.014048	0.001688	0.000229	0.000029	0.065548
SW	0.010672	0.032702	0.015536	0.002289	0.000086	0.000000	0.061285
WSW	0.010643	0.036421	0.016594	0.002031	0.000229	0.000000	0.065918
W	0.011072	0.036421	0.015850	0.002976	0.001059	0.000057	0.067435
WNW	0.009613	0.033274	0.026207	0.008068	0.003233	0.000000	0.080395
NW	0.009585	0.026980	0.017166	0.005608	0.001688	0.000000	0.061027
NNW	0.009241	0.022402	0.008154	0.001144	0.000143	0.000000	0.041084
Total	0.166714	0.515706	0.263818	0.043745	0.009729	0.000287	0.999999

**Table A.4 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the F Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.004522	0.009472	0.007011	0.001002	0.000258	0.000000	0.022265
NNE	0.005294	0.014995	0.016340	0.006525	0.002118	0.000000	0.045272
NE	0.010875	0.046188	0.042811	0.008929	0.000744	0.000000	0.109547
ENE	0.007698	0.035571	0.037231	0.006868	0.001173	0.000000	0.088541
E	0.006324	0.024983	0.022092	0.001374	0.000029	0.000000	0.054802
ESE	0.005495	0.025040	0.019345	0.000973	0.000000	0.000000	0.050853
SE	0.005895	0.018859	0.016770	0.000887	0.000000	0.000000	0.042411
SSE	0.006925	0.022751	0.025956	0.003434	0.001087	0.000000	0.060153
S	0.006811	0.026013	0.031422	0.003177	0.000916	0.000143	0.068482
SSW	0.007040	0.029876	0.026013	0.003434	0.000029	0.000029	0.066421
SW	0.007927	0.037975	0.033253	0.007727	0.000258	0.000000	0.087140
WSW	0.008413	0.042182	0.036029	0.004579	0.000801	0.000114	0.092118
W	0.006382	0.031965	0.028903	0.009158	0.002976	0.000315	0.079699
WNW	0.005523	0.025469	0.025040	0.011161	0.004493	0.000143	0.071829
NW	0.004979	0.015253	0.012620	0.003463	0.001316	0.000000	0.037631
NNW	0.004579	0.012277	0.005323	0.000458	0.000200	0.000000	0.022837
Total	0.104682	0.418869	0.386159	0.073149	0.016398	0.000744	1.000001

**Table A.5 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the H Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.005116	0.013748	0.009747	0.001601	0.000343	0.000000	0.030555
NNE	0.005888	0.019236	0.018779	0.004230	0.000629	0.000000	0.048762
NE	0.009347	0.049163	0.032899	0.002744	0.000200	0.000000	0.094353
ENE	0.007146	0.045475	0.021980	0.001200	0.000000	0.000000	0.075801
E	0.006002	0.035014	0.017693	0.000429	0.000000	0.000000	0.059138
ESE	0.005831	0.034500	0.016235	0.000429	0.000000	0.000000	0.056995
SE	0.005145	0.026668	0.017093	0.000400	0.000000	0.000000	0.049306
SSE	0.005631	0.021780	0.022237	0.002544	0.000514	0.000000	0.052706
S	0.007060	0.030184	0.036272	0.002801	0.000915	0.000000	0.077232
SSW	0.007317	0.034900	0.027725	0.001772	0.000086	0.000029	0.071829
SW	0.007203	0.038816	0.031498	0.004373	0.000171	0.000000	0.082061
WSW	0.007317	0.046876	0.030727	0.002915	0.000657	0.000000	0.088492
W	0.006917	0.038415	0.022152	0.004973	0.001629	0.000086	0.074172
WNW	0.006231	0.030669	0.024181	0.008603	0.002744	0.000029	0.072457
NW	0.006288	0.020208	0.010290	0.002830	0.001058	0.000000	0.040674
NNW	0.005031	0.015892	0.003944	0.000429	0.000171	0.000000	0.025467
Total	0.103470	0.501544	0.343452	0.042273	0.009117	0.000144	1.000000

**Table A.6 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the K Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.004245	0.011501	0.010640	0.002983	0.000574	0.000000	0.029943
NNE	0.004273	0.014742	0.018786	0.005621	0.000889	0.000000	0.044311
NE	0.008862	0.042791	0.039378	0.003614	0.000086	0.000000	0.094731
ENE	0.007141	0.038231	0.034933	0.002725	0.000029	0.000000	0.083059
E	0.006138	0.029799	0.022285	0.001061	0.000000	0.000000	0.059283
ESE	0.005736	0.024636	0.017897	0.000946	0.000057	0.000000	0.049272
SE	0.006654	0.027705	0.020994	0.001262	0.000143	0.000000	0.056758
SSE	0.005650	0.028795	0.033241	0.002782	0.000488	0.000000	0.070956
S	0.006625	0.033269	0.028881	0.001893	0.000602	0.000029	0.071299
SSW	0.007141	0.039722	0.024034	0.001979	0.000057	0.000000	0.072933
SW	0.006969	0.033011	0.026357	0.004675	0.000229	0.000000	0.071241
WSW	0.006310	0.029856	0.026558	0.004990	0.000602	0.000029	0.068345
W	0.005191	0.028394	0.025984	0.010497	0.003499	0.000545	0.074110
WNW	0.005249	0.024837	0.026874	0.012906	0.005306	0.000516	0.075688
NW	0.005249	0.022658	0.015229	0.004216	0.002180	0.000086	0.049618
NNW	0.004216	0.015545	0.007715	0.000660	0.000315	0.000000	0.028451
Total	0.095649	0.445492	0.379786	0.062810	0.015056	0.001205	0.999998

**Table A.7 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the L Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.003747	0.010899	0.010899	0.001545	0.000086	0.000000	0.027176
NNE	0.004606	0.011986	0.019681	0.006580	0.000858	0.000000	0.043711
NE	0.004606	0.031811	0.056841	0.018194	0.001430	0.000000	0.112882
ENE	0.005864	0.036216	0.043768	0.003690	0.000057	0.000000	0.089595
E	0.005321	0.027977	0.019367	0.000744	0.000000	0.000000	0.053409
ESE	0.004806	0.023200	0.014647	0.000458	0.000029	0.000000	0.043140
SE	0.004749	0.021569	0.015591	0.000429	0.000057	0.000000	0.042395
SSE	0.005779	0.025975	0.021369	0.002517	0.000515	0.000000	0.056155
S	0.006723	0.039448	0.024802	0.002031	0.000915	0.000057	0.073976
SSW	0.008096	0.052836	0.028864	0.004978	0.000229	0.000086	0.095089
SW	0.007581	0.040536	0.025031	0.006436	0.001001	0.000057	0.080642
WSW	0.007123	0.036502	0.025517	0.004749	0.001001	0.000200	0.075092
W	0.006494	0.034099	0.025689	0.006436	0.002775	0.000029	0.075522
WNW	0.004491	0.023143	0.027119	0.010213	0.002918	0.000057	0.067941
NW	0.003890	0.016220	0.014904	0.002889	0.000944	0.000000	0.038847
NNW	0.004520	0.014761	0.004720	0.000400	0.000029	0.000000	0.024430
Total	0.088396	0.447178	0.378809	0.072289	0.012844	0.000486	1.000002

**Table A.8 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the P Area Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.003687	0.011775	0.010432	0.001801	0.000257	0.000000	0.027952
NNE	0.004116	0.013776	0.016977	0.006259	0.001115	0.000000	0.042243
NE	0.007231	0.037156	0.049388	0.011575	0.000886	0.000000	0.106236
ENE	0.009432	0.057848	0.023922	0.001000	0.000000	0.000000	0.092202
E	0.006974	0.031525	0.019292	0.000743	0.000000	0.000000	0.058534
ESE	0.005773	0.026123	0.012404	0.000600	0.000000	0.000000	0.044900
SE	0.005373	0.021750	0.016663	0.000457	0.000086	0.000000	0.044329
SSE	0.005087	0.022008	0.018635	0.002315	0.000429	0.000000	0.048474
S	0.006631	0.027638	0.039299	0.003030	0.000943	0.000000	0.077541
SSW	0.005202	0.032926	0.037670	0.002830	0.000114	0.000000	0.078742
SW	0.005659	0.035041	0.037184	0.006059	0.000143	0.000029	0.084115
WSW	0.005659	0.034983	0.035241	0.004316	0.000600	0.000000	0.080799
W	0.004544	0.029039	0.034440	0.007974	0.003058	0.000171	0.079226
WNW	0.004402	0.022150	0.027609	0.011575	0.005545	0.000114	0.071395
NW	0.003944	0.015348	0.015748	0.003973	0.002429	0.000029	0.041471
NNW	0.003115	0.011432	0.006745	0.000257	0.000286	0.000000	0.021835
Total	0.086829	0.430518	0.401649	0.064764	0.015891	0.000343	0.999994

**Table A.9 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 4m Level Central Climatology Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.018761	0.006559	0.000802	0.000029	0.000000	0.000000	0.026151
NNE	0.035087	0.016985	0.001719	0.000029	0.000000	0.000000	0.053820
NE	0.049437	0.036834	0.001346	0.000000	0.000000	0.000000	0.087617
ENE	0.032366	0.029158	0.001031	0.000000	0.000000	0.000000	0.062555
E	0.039269	0.031478	0.000601	0.000000	0.000000	0.000000	0.071348
ESE	0.067224	0.023802	0.000601	0.000000	0.000000	0.000000	0.091627
SE	0.075158	0.012460	0.000258	0.000000	0.000000	0.000000	0.087876
SSE	0.068055	0.017386	0.001117	0.000000	0.000000	0.000000	0.086558
S	0.045284	0.014665	0.000659	0.000086	0.000000	0.000000	0.060694
SSW	0.036319	0.013118	0.000172	0.000000	0.000000	0.000000	0.049609
SW	0.030848	0.015925	0.000200	0.000000	0.000000	0.000000	0.046973
WSW	0.033999	0.023000	0.001375	0.000029	0.000000	0.000000	0.058403
W	0.035316	0.033827	0.003752	0.000831	0.000029	0.000000	0.073755
WNW	0.016355	0.034543	0.012803	0.004468	0.000516	0.000000	0.068685
NW	0.014465	0.018016	0.006903	0.002120	0.000143	0.000000	0.041647
NNW	0.019821	0.012144	0.000687	0.000029	0.000000	0.000000	0.032681
Total	0.617764	0.339900	0.034026	0.007621	0.000688	0.000000	0.999999

**Table A.10 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 18m Level Central Climatology Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.023212	0.007872	0.000926	0.000000	0.000000	0.000000	0.032010
NNE	0.025035	0.020202	0.003444	0.000174	0.000000	0.000000	0.048855
NE	0.028219	0.046540	0.008683	0.000145	0.000000	0.000000	0.083587
ENE	0.028277	0.042054	0.009754	0.000405	0.000000	0.000000	0.080490
E	0.031663	0.040057	0.006454	0.000203	0.000000	0.000000	0.078377
ESE	0.027177	0.034037	0.002750	0.000000	0.000000	0.000000	0.063964
SE	0.025788	0.021128	0.001042	0.000029	0.000000	0.000000	0.047987
SSE	0.029435	0.033400	0.003242	0.000058	0.000000	0.000000	0.066135
S	0.037452	0.026830	0.002547	0.000434	0.000058	0.000000	0.067321
SSW	0.032792	0.023270	0.001592	0.000029	0.000000	0.000000	0.057683
SW	0.028132	0.027264	0.004544	0.000058	0.000000	0.000000	0.059998
WSW	0.025875	0.038581	0.009725	0.000724	0.000087	0.000000	0.074992
W	0.018147	0.040896	0.014558	0.003849	0.001534	0.000058	0.079042
WNW	0.014963	0.028856	0.015455	0.008278	0.003560	0.000000	0.071112
NW	0.021533	0.017713	0.006310	0.002315	0.000376	0.000000	0.048247
NNW	0.027061	0.012069	0.000897	0.000174	0.000000	0.000000	0.040201
Total	0.424761	0.460769	0.091923	0.016875	0.005615	0.000058	1.000001

**Table A.11 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 36m Level Central Climatology Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.008856	0.017018	0.003241	0.000463	0.000000	0.000000	0.029578
NNE	0.009059	0.024658	0.008277	0.001534	0.000087	0.000000	0.043615
NE	0.012821	0.049780	0.023472	0.002836	0.000029	0.000000	0.088938
ENE	0.011490	0.049780	0.020896	0.002402	0.000058	0.000000	0.084626
E	0.009406	0.041589	0.016121	0.000695	0.000000	0.000000	0.067811
ESE	0.009319	0.037190	0.006859	0.000145	0.000000	0.000000	0.053513
SE	0.008596	0.031431	0.003762	0.000058	0.000029	0.000000	0.043876
SSE	0.009638	0.046075	0.008451	0.000897	0.000000	0.000000	0.065061
S	0.011664	0.053890	0.006280	0.001158	0.000260	0.000000	0.073252
SSW	0.012619	0.046423	0.006975	0.000174	0.000029	0.000000	0.066220
SW	0.011635	0.044252	0.012503	0.001187	0.000029	0.000000	0.069606
WSW	0.010853	0.049346	0.016902	0.003791	0.000492	0.000000	0.081384
W	0.009493	0.041995	0.023038	0.005152	0.002981	0.000174	0.082833
WNW	0.010014	0.032936	0.017278	0.009406	0.005238	0.000116	0.074988
NW	0.013690	0.022343	0.006657	0.002692	0.000839	0.000000	0.046221
NNW	0.010940	0.015484	0.001823	0.000203	0.000029	0.000000	0.028479
Total	0.170093	0.604190	0.182535	0.032793	0.010100	0.000290	1.000001

**Table A.12 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 61m Level Central Climatology Tower, 2007**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.004458	0.011435	0.008858	0.001737	0.000376	0.000000	0.026864
NNE	0.003763	0.012303	0.014851	0.005442	0.000666	0.000000	0.037025
NE	0.004805	0.029441	0.040412	0.010479	0.000840	0.000000	0.085977
ENE	0.005240	0.031728	0.037662	0.006427	0.000492	0.000000	0.081549
E	0.005674	0.029817	0.032741	0.002403	0.000029	0.000000	0.070664
ESE	0.005153	0.022348	0.021017	0.001303	0.000029	0.000000	0.049850
SE	0.005645	0.019077	0.017890	0.000550	0.000058	0.000000	0.043220
SSE	0.005906	0.022783	0.028978	0.003416	0.000492	0.000000	0.061575
S	0.006195	0.025301	0.036881	0.003097	0.000868	0.000087	0.072429
SSW	0.006484	0.032046	0.028920	0.002316	0.000058	0.000000	0.069824
SW	0.006571	0.032770	0.030657	0.005819	0.000289	0.000000	0.076106
WSW	0.006542	0.033638	0.037575	0.007498	0.001013	0.000058	0.086324
W	0.006224	0.032133	0.033494	0.010045	0.003126	0.000579	0.085601
WNW	0.005848	0.025127	0.025098	0.013924	0.006716	0.000289	0.077002
NW	0.008424	0.023969	0.011145	0.003734	0.001476	0.000000	0.048748
NNW	0.006137	0.015922	0.004719	0.000318	0.000145	0.000000	0.027241
Total	0.093069	0.399838	0.410898	0.078508	0.016673	0.001013	0.999999

Table A.13 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Winter 2007

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.003727	0.012930	0.007455	0.001398	0.000000	0.000000	0.025510
NNE	0.003378	0.009668	0.006756	0.002796	0.000000	0.000000	0.022598
NE	0.002679	0.024345	0.013745	0.005591	0.000233	0.000000	0.046593
ENE	0.004077	0.022015	0.024927	0.001631	0.000116	0.000000	0.052766
E	0.004543	0.020384	0.029703	0.001747	0.000000	0.000000	0.056377
ESE	0.004659	0.013745	0.023529	0.002213	0.000116	0.000000	0.044262
SE	0.005242	0.015492	0.018171	0.000699	0.000000	0.000000	0.039604
SSE	0.005009	0.019220	0.031334	0.004077	0.001281	0.000000	0.060921
S	0.004077	0.024811	0.037158	0.005358	0.003262	0.000116	0.074782
SSW	0.003494	0.021083	0.022598	0.004426	0.000233	0.000000	0.051834
SW	0.004310	0.023413	0.041118	0.010833	0.000699	0.000000	0.080373
WSW	0.005475	0.028305	0.055679	0.009319	0.000932	0.000116	0.099826
W	0.004776	0.031916	0.056727	0.021200	0.004543	0.000000	0.119162
WNW	0.005824	0.023296	0.041817	0.031916	0.011415	0.000349	0.114617
NW	0.009552	0.034828	0.021083	0.005708	0.001281	0.000000	0.072452
NNW	0.004776	0.024461	0.008387	0.000699	0.000000	0.000000	0.038323
Total	0.075598	0.349912	0.440187	0.109611	0.024111	0.000581	1.000000

Table A.14 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Spring 2007

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.002587	0.011171	0.005762	0.003175	0.001176	0.000000	0.023871
NNE	0.003410	0.012230	0.014817	0.007643	0.002469	0.000000	0.040569
NE	0.003057	0.025753	0.032455	0.005997	0.001881	0.000000	0.069143
ENE	0.005409	0.029516	0.029398	0.004704	0.000000	0.000000	0.069027
E	0.005762	0.027046	0.029986	0.003410	0.000000	0.000000	0.066204
ESE	0.005527	0.029516	0.022813	0.001058	0.000000	0.000000	0.058914
SE	0.005174	0.023636	0.024459	0.000706	0.000118	0.000000	0.054093
SSE	0.006115	0.024459	0.044920	0.006585	0.000118	0.000000	0.082197
S	0.004351	0.033161	0.051152	0.002705	0.000000	0.000000	0.091369
SSW	0.005292	0.040922	0.034219	0.001999	0.000000	0.000000	0.082432
SW	0.005762	0.033514	0.027046	0.004351	0.000353	0.000000	0.071026
WSW	0.005174	0.031515	0.026341	0.009290	0.001881	0.000118	0.074319
W	0.004821	0.028457	0.027046	0.011642	0.004586	0.002352	0.078904
WNW	0.005174	0.022578	0.023754	0.014229	0.008467	0.000470	0.074672
NW	0.006468	0.019403	0.010583	0.005056	0.002587	0.000000	0.044097
NNW	0.005056	0.010701	0.002469	0.000353	0.000588	0.000000	0.019167
Total	0.079139	0.403578	0.407220	0.082903	0.024224	0.002940	1.000004

Table A.15 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Summer 2007

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.007135	0.010985	0.003284	0.000227	0.000340	0.000000	0.021971
NNE	0.004530	0.015289	0.007928	0.001246	0.000000	0.000000	0.028993
NE	0.008494	0.030011	0.045413	0.014156	0.000793	0.000000	0.098867
ENE	0.007928	0.041789	0.042582	0.007248	0.000566	0.000000	0.100113
E	0.007928	0.041450	0.040204	0.003058	0.000000	0.000000	0.092640
ESE	0.005889	0.028199	0.018686	0.000680	0.000000	0.000000	0.053454
SE	0.006795	0.025142	0.016082	0.000453	0.000113	0.000000	0.048585
SSE	0.006342	0.032729	0.027746	0.001133	0.000227	0.000000	0.068177
S	0.009853	0.029672	0.030578	0.000793	0.000113	0.000227	0.071236
SSW	0.009400	0.042582	0.024802	0.000680	0.000000	0.000000	0.077464
SW	0.011665	0.048245	0.021518	0.001246	0.000000	0.000000	0.082674
WSW	0.009853	0.046886	0.033069	0.003624	0.000340	0.000000	0.093772
W	0.009513	0.036693	0.019819	0.001246	0.000453	0.000000	0.067724
WNW	0.005663	0.024462	0.011665	0.002378	0.000453	0.000000	0.044621
NW	0.008041	0.015062	0.002831	0.000793	0.000113	0.000000	0.026840
NNW	0.008041	0.013477	0.001359	0.000000	0.000000	0.000000	0.022877
Total	0.127070	0.482673	0.347566	0.038961	0.003511	0.000227	1.000008

Table A.16 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Fall 2007

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00429	0.01067	0.01901	0.00220	0.00000	0.00000	0.036174
NNE	0.00371	0.01194	0.03003	0.01020	0.00023	0.00000	0.056116
NE	0.00487	0.03757	0.06968	0.01600	0.00046	0.00000	0.128580
ENE	0.00348	0.03328	0.05345	0.01206	0.00128	0.00000	0.103535
E	0.00441	0.03003	0.03084	0.00139	0.00012	0.00000	0.066783
ESE	0.00452	0.01786	0.01913	0.00128	0.00000	0.00000	0.042782
SE	0.00533	0.01194	0.01299	0.00035	0.00000	0.00000	0.030609
SSE	0.00615	0.01449	0.01217	0.00197	0.00035	0.00000	0.035131
S	0.00638	0.01357	0.02899	0.00359	0.00012	0.00000	0.052638
SSW	0.00765	0.02342	0.03420	0.00220	0.00000	0.00000	0.067478
SW	0.00441	0.02551	0.03316	0.00696	0.00012	0.00000	0.070145
WSW	0.00557	0.02748	0.03525	0.00788	0.00093	0.00000	0.077101
W	0.00568	0.03130	0.03073	0.00638	0.00301	0.00000	0.077101
WNW	0.00673	0.03015	0.02354	0.00754	0.00673	0.00035	0.075015
NW	0.00962	0.02678	0.01032	0.00348	0.00197	0.00000	0.052174
NNW	0.00661	0.01507	0.00673	0.00023	0.00000	0.00000	0.028638
Total	0.089392	0.361042	0.450203	0.083710	0.015305	0.000348	1.000000